

272
(3)

APPENDIX G

TO

REPORT OF COMMITTEE

UPON

THE FEVER HOSPITAL

AND

MUNICIPAL IMPROVEMENTS:

CONTAINING

A COPY OF THE MINUTE, ON THE DRAINAGE OF THE SALT WATER LAKE, BY THE GOVERNOR
GENERAL (LORD WILLIAM CAVENDISH BENTINCK, K. C. B.) IN THE FINANCIAL AND
REVENUE DEPARTMENTS DATED 2d FEBRUARY 1830, AND ITS CONNECTED PAPERS.

CALCUTTA:

Bishop's College Press.

1841.

AMERICAN MEDICAL ASSOCIATION
PUBLISHED WEEKLY
CHICAGO, ILL., U.S.A.

VOLUME 100

NUMBER 10

5

CONTENTS

ORIGINAL ARTICLES

1. The Effect of the Diet on the Blood Sugar in the Normal Adult Male
2. The Effect of the Diet on the Blood Sugar in the Normal Adult Female
3. The Effect of the Diet on the Blood Sugar in the Normal Adult Male and Female
4. The Effect of the Diet on the Blood Sugar in the Normal Adult Male and Female
5. The Effect of the Diet on the Blood Sugar in the Normal Adult Male and Female

APPENDIX, (G.)

Contents.

	PAGE.
No. I.—Minute by the Governor General in the Financial and Revenue Departments, dated 2nd February 1830, received with Mr. Secretary F. J. Halliday's letter of the 18th September, 1838. . .	1 to 5
No. I. (A)—Major Schalch's Memoir on a Plan for the Formation of an easy and permanent Communication between the Upper and Eastern Provinces of India and Calcutta by Water, [through the Soondurbund passages and Salt Water Lake,] during the Dry Season,	6
No. I. (B)—Surveys of the Salt Water Lakes, or Marshes adjoining Calcutta, by Capt. T. Prinsep, dated December 1828 and 1830, opposite	6
No. I. (C)—Survey of the Soondurbuns, by Capt. T. Prinsep, opposite . .	6
No. I. (D)—Queries put by Lord William C. Bentinck, Governor General, to Capt. T. Prinsep, Honorable Company's Engineers, and his Answers thereto,	6 to 12
No. I. (E)—Tables exhibiting a Daily Register of the Tides in the River Hoogly, at Calcutta, from 1805 to 1828; with observation on the results thus obtained, by James Kyd, Esq.	13 to 16
No. I. (F)—Capt. Prinsep's Memorandum and Diagram on Tolly's Nullah,	17
No. I. (G)—Capt. Prinsep's Memorandum on the Salt-Water Lakes, in the vicinity of Calcutta; with suggestions for filling them up by Warping,	17 to 23
No. I. (G 1.)—Scheme for raising the bed of the Lake to a level fit for purposes of cultivation, with statement of expense,	23 to 24
No. I. (G 2.)—Table of Land and Tide Levels, by Capt. T. Prinsep, . .	25
No. I. (H)—Capt. T. Prinsep's Memoranda in reply to his Lordship's Questions of the 29th and 30th December, 1829,	25 & 26

	PAGE.
No. I. (1)—Letter from W. Dampier, Esq. Commissioner, dated 13th January, 1830, to Holt Mackenzie, Esq. Secretary to Government, Territorial Department,	26
No. II.—Letter from Holt Mackenzie, Esq. dated 16th February, 1830, to the Secretary to the Honorable the Court of Directors, transmitting the Papers noted in the Paper marked No. II (A),	27
No. II. (A)—List of Documents referred to in the Minute of the Governor General, dated the 2nd February, 1830,	<i>Ibid.</i>
No. III.—Extract from the Honorable the Court of Directors' Letter, dated the 10th November, 1830,	28
No. IV.—Letter from C. Macsween, Esq. dated 2nd September, 1833, to Captain Young, Secretary to the Military Board,	29
No. V.—Minute on the Drainage of the Salt Water Lake, with seven connected Maps and Plans, &c. by Colonel Sir Thomas Anbury, C. B. submitted by him to Lord William C. Bentinck, Governor General, in it is believed, December, 1833,	30 to 36
No. VI.—Letter from the Military Board, dated 7th February, 1834, to the Hon'ble Sir C. T. Metcalfe, Bart. Vice-President in Council, transmitting the Papers marked No. VI. (A), No. VI. (B), No. VI. (B 1), No. VI. (B 2),	37
No. VI. (A)—Letter from the Secretary to the Military Board, dated 27th September, 1833, to the Committee (to wit, Capt. W. N. Forbes, Capt. J. Thomson, and James Prinsep, Esq.) appointing them a Committee to Report on the Drainage of the Salt Water Lake,	<i>Ibid.</i>
No. VI. (B)—Report and accompanying Plan, by the Committee, (to wit the above Committee) dated 11th January, 1834,	38
No. VI. (B 1.)—Description of the Ground lying South-eastward from Calcutta, by Capt. J. Thomson, 11th January, 1834,	39 & 40
No. VI. (B 2.)—Rough Estimate of the probable expense of Draining the Salt Water Lake, agreeably to the Plan recommended in the foregoing Report, marked No. VI. (B),	41 to 44
No. VI. (c)—Minute on the Salt Water Lake, accompanied with a Plan, by Colonel Galloway,	44 to 48
No. VI. (d) <i>Ibid.</i> —By Chief Engineer (Col. Sir Thomas Anbury, C. B.)	48 to 50

	PAGE.
No. VI. (E.)—Minute on the Salt Water Lake, by Col. Craigie,	50
No. VI. (F)—Ibid.—By D. M'Farlan, Esq.	51
No. VII.—Extract from a Dispatch to the Honorable the Court of Directors of the East India Company, in the Revenue Department, dated the 23rd December, 1835, No. 10,	52
No. VIII.—Extract of a Letter from Mr. Secretary R. D. Mangles to the Military Board, transmitting a Dispatch, dated 18th January 1837, from the Honorable Court of Directors to the address of the Government of India,	53
No. VIII. (A)—Extract of a Dispatch from the Honorable Court of Directors to the address of the Government of India, No. 2 of 1837, Revenue Department,	54
No. IX.—Extract from a Dispatch from the Honorable Court of Directors, No. 4, dated the 2nd May, 1838, in the Revenue Department,	<i>Ibid.</i>
No. X.—Extract from a Resolution by the Honorable the President of the Council of India in Council, in the Revenue Department, dated the 20th August, 1838,	55
No. XI.—Letter from F. J. Halliday, Esq. dated 18th September, 1838, to the Municipal Committee, transmitting the Papers connected with Lord William C. Bentinck's Minute,	56

APPENDIX (G.)

No. I.

Minute by the Governor General in the Financial and Revenue Departments, dated 2nd February 1830, with connected papers, received with Mr. Secretary F. J. HALLIDAY'S letter of 18th September, 1838.*

Territorial Department. Consultation,
16th February, 1830. No. 7.

ON THE SUBJECT OF DRAINING THE SALT WATER LAKE, AND IMPROVING THE CANAL.

1. Possessing no scientific knowledge of Civil Engineering, I shall no doubt be considered guilty of great presumption, in venturing to submit to Council a scheme for the construction of works of great magnitude and expense, connected with that art. I may be permitted, however, to say in my defence, that during the last fourteen years I have been constantly and actively employed as a Commissioner for drainage and navigation in the great level of the Fens. During this period very extensive improvements in the rivers Nene and Ooze have been and are still going on, under the direction of Mr. Telford and the late Mr. Rennie, the latter of whom has been succeeded by his sons, Messrs. George and John Rennie. These undertakings have been, in several Sessions of Parliament, the subject of long and warm contention. The opinions elicited upon these occasions from the first Engineers, together with a long practical observation of the progress and result of these measures, could not but impart some knowledge at least of general principles. The local features of that part of England bear a striking analogy to those of Bengal. There exists the same lowness and flatness of surface ; the same liability to inundation, both from the Upland and Tidal waters ; the same difficulty of drainage ; and the same impediments to navigation from the constant formation of sand banks, arising from the ever varying and enlarging channels of its rivers ; and, unfortunately, the same unhealthiness of climate. But there is this material difference, that here a gigantic character pervades the whole. The immense Ganges fed by its many tributary streams, and all taking their rise in the highest mountains of the world, varying in depth from 40 feet in the rains, to less than 3 feet, in some places, in the dry weather, running a course of above 1000 miles, has been hitherto quite uncontrollable by the art or science of man. It may however be questioned whether the sands which obstruct the mouths of the Bagherutte and Jellinghee, at the point of separation from the Ganges, their parent stream, and which during the dry weather positively interrupt all

* This Minute, together with the papers marked here as No. I. (D) No. I. (F) No. I. (G) are printed in Appendix (D) page 233 to 253 inclusive, but owing to their not having been correctly printed, and for greater convenience and uniformity, they have been reprinted in this Appendix.—J. M.

navigation, might not yield to the superior experience and science of European Engineers. But, be this as it may, in both cases the principle upon which alone any improvement can be made, must be precisely similar; and upon the present occasion, I feel confident in the correctness of the suggestion I have to offer, only so far as it has nothing of novelty in it, and that it is in strict conformity with the principles, and is in great measure an exact copy of works planned and executed by the great Engineers before mentioned.

No. 1. *Major Schalch's Memoir on a Plan for the Formation of an easy and permanent Communication by Water between the Upper and Eastern Provinces of India and Calcutta, during the dry Season.*

2. My project has reference to the Canal, which is to connect the Salt-Water Lakes with the Hoogley. This plan originated with the late Major Schalch, and is now in execution under the direction of Captain Prinsep. This work is one of great utility, very much required by the commercial interests of Calcutta, and must prove a source of prosperity to the country in general, as well as of revenue to the Government.

3. Highly however as I think of the general measure, it strikes me that the line of the Canal may be greatly improved, and that with this improvement may be connected the execution of another object of equal utility and advantage with the Canal itself, namely the draining and warping up the Salt-Water Lake, the area of which comprises eighteen and a half square miles, or about 12,000 acres.

4. By a reference to plan marked No. 2,* the new Circular Canal, now executing, is marked by a blue line, one extremity opening into the Hoogley, the other joining the Entally Canal. This latter cut was made about twenty years ago. It communicates with the Salt-Water Lake, through which there is a navigable channel, which enters a creek, directly communicating with the sea, as will be seen in the general map of the Soonderbunds No. 3,† and is within the influence of the daily tides. The depth of the water, in ordinary tides, in this channel varies in proportion to the amount of back water brought to bear upon its different parts; at the most distant point not being more than 2 and $2\frac{1}{2}$ feet, while at the lower end, previous to, and at its junction with the creek, it is not less than 15 and 20 feet, and so continues increasing in width and depth till its junction with the sea. The various depths of the channel, as well as of the water in the Lake, are marked in the map, No. 2.

5. The change which I have to recommend in this plan, is, that the New Circular Canal, instead of terminating at the Entally Canal, shall be continued round the Lake, and as close to it as possible; and shall enter the creek at deep water below Bahmunghatta, that the lake shall be drained and subsequently warped up. The red line on the map, No. 2, marks the direction of the proposed new cut.

6. Before proceeding further, it will be necessary to a due understanding of the questions of drainage and navigation, which have to be considered, that a statement should be given of the levels of Calcutta, and of the adjacent country, and of the surface

* † The Original Maps or Surveys marked No. 2, and No. 3, and on which the work suggested by his Lordship is laid down, were transmitted to the Honorable Court of Directors [See note at foot of paper marked No. II. A.] but reference to the annexed Survey, copied from the original by Capt. T. Prinsep, 1828, or to that gentleman's Map of the Suburbs of Calcutta 1830, and to his Map of the Soondurbuns, or that published by Lieut A. Hodges, 1837, and to the Map annexed to the paper marked No. VI. (c) will exhibit what is desired.—J. M

and bottom of the Salt-Water Lake, as compared with the high and low water mark, in ordinary and spring tides and during the freshes in the Hoogley, in the Lake, and at Bahmunghatta. In the gauge table annexed to Capt. Prinsep's answers (No. 4.) to certain questions put to him by me, this information will be found.

7. It will be observed that the believed lowest bed of the Salt Lake is at 2, that the depth is from $1\frac{1}{2}$ to 2 feet, and no where exceeds $2\frac{1}{2}$ feet, that the neap tides in the Hoogley in March, are 5 feet 4 inches, and the lowest springs in March, 7 feet 5 inches below the lowest bed of the lake; in the one case giving 3 feet 4 inches, and in the other 5 feet 5 inches, fall. It is evident from this, the complete drainage of the Lake either into the Hoogley itself, or into the Canal is perfectly practicable.

8. The warping up of the Lake is a still more easy and certain operation, in as much as in the months of March, April, and May, the springs in the Hoogley are ten feet higher than the lowest bed of the Lake; and the highest rise of the river in August and September is between 15 and 16 feet.—Vide Daily Register of Tides in the Hoogley, at Calcutta from 1805 to 1828,* by James Kyd, Esq. (No. 5.)

9. Nor can a doubt be for one moment entertained of the great superiority of a deep Canal of fixed and even dimensions, with high banks serving as roads and towing paths, over a navigable shallow channel, through an open lake, only to be kept open by the use of a dredging machine, and not having the benefit of a lateral embankment, except it be made at a considerable expense.

10. In consequence of the height of the freshes in August and September exceeding the surface of the lower part of Calcutta by near six feet, and the adjacent plains between seven and eight feet, it was necessary to erect lock gates at the mouth of the Canal. This precaution would not be requisite if the Canal was cut over the dry land, and the sides raised to a level, if thought more secure, of the banks of the Hoogley itself. I consider these locks to be objectionable, in as much as when shut, they produce a suspension of the current, and a consequent deposit of silt. It may be expected that this process of silting up, so great in the Entally Canal, and in the adjoining part of the Lake, may be much diminished, when, by the New Canal, the tides will ebb and flow daily, and that during the rains there will be a more rapid current. This will no doubt be the case in the overland cut, and I think it not impossible that the bottom of the new cut, by the effect of the scouring of the water in its confined channel, may be brought to the same depth as the Hoogley at one end, and the creek at the other, or between 15 and 20 feet at low water mark. This can never be the case in the channel in the open Lake, in which the current, being unconfined, will spend much of its force, and if a rapid current is not to be obtained, the silting process may be greater than before, because the water by which the Lake and the Entally Canal are now filled, is exclusively tidal and clear; whereas the waters of the Hoogley bringing down the upland collections of a thousand miles, and passing during the latter part of its course through the rich loose soil of Bengal, contains a greater portion of deposit matter than the Humber, or any of the rivers flowing into the great estuary between the countries† of Lincoln and Norfolk.

† Qy. Counties.—
J. M.

11. It is necessary to notice Tolly's Nullah, which is now the only communication from the Hoogley and Calcutta with the Soonderbunds, and all the districts to the Eastward bordering on the Ganges and Burumpooter. The crowded state of this Canal, even to

* NOTE.—The Register of subsequent years has since been obtained.—Vide Map No. 4. of the Paper marked No. I. (E).—J. M.

excess at all times, proves the want of additional accommodation to the general commercial intercourse by inland navigation. By a reference to Captain Prinsep's Memorandum and Diagram, marked No. 6, the great imperfection of this channel will be at once seen. At each extremity of its course, in the deep creek to the east and the Hoogley to the west, there is great depth of water, which would probably be preserved throughout the Nullah itself, if its course was less tortuous; if the waters were properly confined by banks; if the dimensions throughout were of equal width; and if bridges having an insufficient water way, did not, by interrupting the rapidity of the current, create a formation of sand banks. The free ingress of the high and strong freshes from the Hoogley, in the rains, produces no inconvenience at the mouth of the Nullah, or to the surrounding country by inundation.

12. The drainage of Calcutta has always been an imperfect operation, but the proposed continuation of the Circular Canal will not affect this in any way. The question does not belong to this paper, and I will only generally say, that I think it susceptible of very great improvement.

13. The drainage of the Salt-Water Lake is obviously so easy a measure with the fall into the Canal at low water, that nothing need be said of it.

14. Warping is a process entirely unknown in India; and I conceive it would be very important that an opinion of some Engineer of eminence in England, conversant with the practice as observed in Yorkshire and Lincolnshire should be obtained upon this part of the subject. Captain Prinsep in the paper marked (No. 7,) has given a very ingenious plan for the gradual silting up of the Lake. I feel however confident that a much better mode of effecting this object may be pursued. In my judgment, the Lake should be *first* drained. When the water has been completely let off, it will be seen whether it is necessary to warp it up or not. It is essential, in order to render this improvement conducive to one main end of its execution, the general health of Calcutta, that there should be no stagnant water whatever. The next point to examine is whether the soil will be sufficiently good not to require the amelioration which warping would produce. It would also be necessary before the warping took place, that all the marine jungle should be entirely rooted out. If the expense of making the banks and sluices, &c., incident to warping* could be saved, the profit of the undertaking would be proportionately great.

15. I now come to the Financial part of the plan.

16. Captain Prinsep states (No. 8.) the cost of the new Circular Canal to be about ten thousand Rupees or 1,000*l.* per mile. The distance to be cut is 8 miles or 80,000 Rupees or 8,000*l.* No locks are necessary, as the country is a dead flat. Some drains through the banks might be necessary, but if these were estimated at 20,000 Rupees, or 2,000*l.* the expense would probably be more than covered.

17. The lake according to Captain Prinsep's estimate contains $18\frac{1}{2}$ square miles, equal to 12,000 acres or 36,000 Bengal beegahs. The lowest rent of these lands near Calcutta is 2 Rupees per Beegah. I take the lowest amount of rent, as well as produce of the lowest value. Such land might reasonably be expected to grow Indigo,

* NOTE—In order to warp up the Salt-Water Lake to a level with the surface of the surrounding country, it will be necessary that the water introduced from the Hoogley or the Canal should stand two or more feet above the present surface of the Lake. To effect this, a bank of this height must be made round the Lake. In fact one bank of the New Canal will perform this service, and round the remainder there must, at any rate, be made a catch-water drain to receive the drainage water now discharging itself into the Lakes, and the earth from this drain will, without much additional cost, surround the whole circumference of the Lake.

Cotton, or Sugar. The yearly produce at two Rupees per beegah would be 72,000 or 7,200*l*. or very nearly equal to the whole cost of the cut. Mr. Dampier (No. 9.) the Commissioner of the Soonderbunds, in whose jurisdiction the Salt-Water Lake is situated, estimates the quantity of Beegahs at 60,000, and the rent at more than two Rupees. But it will be safer to take Captain Prinsep's estimate.

18. I think that the general salubrity of this great city, and the vast improvement to navigation by a good canal, instead of a shallow channel through the open Lake, are objects of such superior importance, that I put all gain and profit out of the question. But it would be satisfactory at any rate, even without any prospect of collateral advantage, that so much good could be attained at so little cost.

19. It is necessary to remark, that the Salt-Water Lake has been disposed of in perpetuity, paying a rent of about 4,000 Rs. to Government. The profit to the Zemindars, as I learn from the Commissioner, from the fisheries, from reeds, and from lands from which the waters have receded, amounts to about 16,000 Rupees. I learn from the same source, that the proprietors would not be unwilling to sell their property. There is a doubt whether the land as well as the water, and the right of fishery, belongs to the Zemindar or to the Sirkar. The right is about to be tried.

20. I would beg leave to propose that this Minute with its accompanying documents, may be submitted to the Honorable Court, with my humble request that the plan may be laid before Messrs. Telford and John and George Rennie, for their opinion upon its practicability, and for such suggestions and directions as they are so well enabled to give for its execution. I propose these gentlemen, because having been the Engineers in the works to which I have been a party, they will better understand my meaning.

21. I would further propose, if the Court should feel doubtful of the practicability, or if satisfied upon that head, should be unwilling to undertake it, that they will permit individuals including their servants to embark their money in the work.

22. It would be fair I think, that one half of the expense of the new proposed Cut should be borne by the Company in return for the improved navigation, and the greater increase of tolls that accrue therefrom. The proprietors of the Salt-Water Lake would of course continue to pay the same jumma to Government as heretofore.

23. I would further beg leave to state my conviction of the incalculable benefit that might be derived from the deputation to India, for two or three years, of an eminent Civil Engineer, well acquainted with all the improvements of latter years; who should visit our territories, and report upon the possibility of calling forth the hidden and dormant resources of our immense empire, by the skilful application of improved science and modern invention.

W. BENTINCK.

2nd February, 1830.

No. I. (A)

No. 1.

Major Schalch's Memoir on a Plan for the Formation of an easy and permanent Communication between the Upper and Eastern Provinces of India and Calcutta by Water, through the Soondurbund passages and Salt-Water Lake, during the dry Season. (For this paper, vide the first page of App. to App. G.)

Territorial Department. Revenue. Consultations, of the
28th July, 1821, No. 6,—and 16th Feb. 1830, No.—

No. I. (B)

No. 2.

Survey of the Salt-Water Lakes or Marshes adjoining Calcutta, by Capt. T. Prinsep, dated December, 1828. (Vide Note at foot of page 2.)

Territorial Department. Revenue. Consultation,
16th Feb. 1830, No.—

No. I. (c)

No. 3.

Survey of the Sundurbuns by Ditto. (Vide Note at foot of page 2.)

Territorial Department. Revenue Consultation,
16th Feb. 1830, No.—

No. I. (D)

No. 4.

Queries put by Lord William C. Bentinck, Governor General, to Capt. T. Prinsep, Honble. Company's Engineers, and his Answers thereto.

Territorial Department. Revenue. Consultation,
16th Feb. 1830, No. 8.

HIS LORDSHIP'S QUERIES.

REPLIES.

1. Ordinary high water mark at Chaundpaul Ghaut ?
2. Ditto at spring tides ?
3. Ordinary low water mark ?
4. Ditto at spring tides ?
5. Same four questions during the rains ?

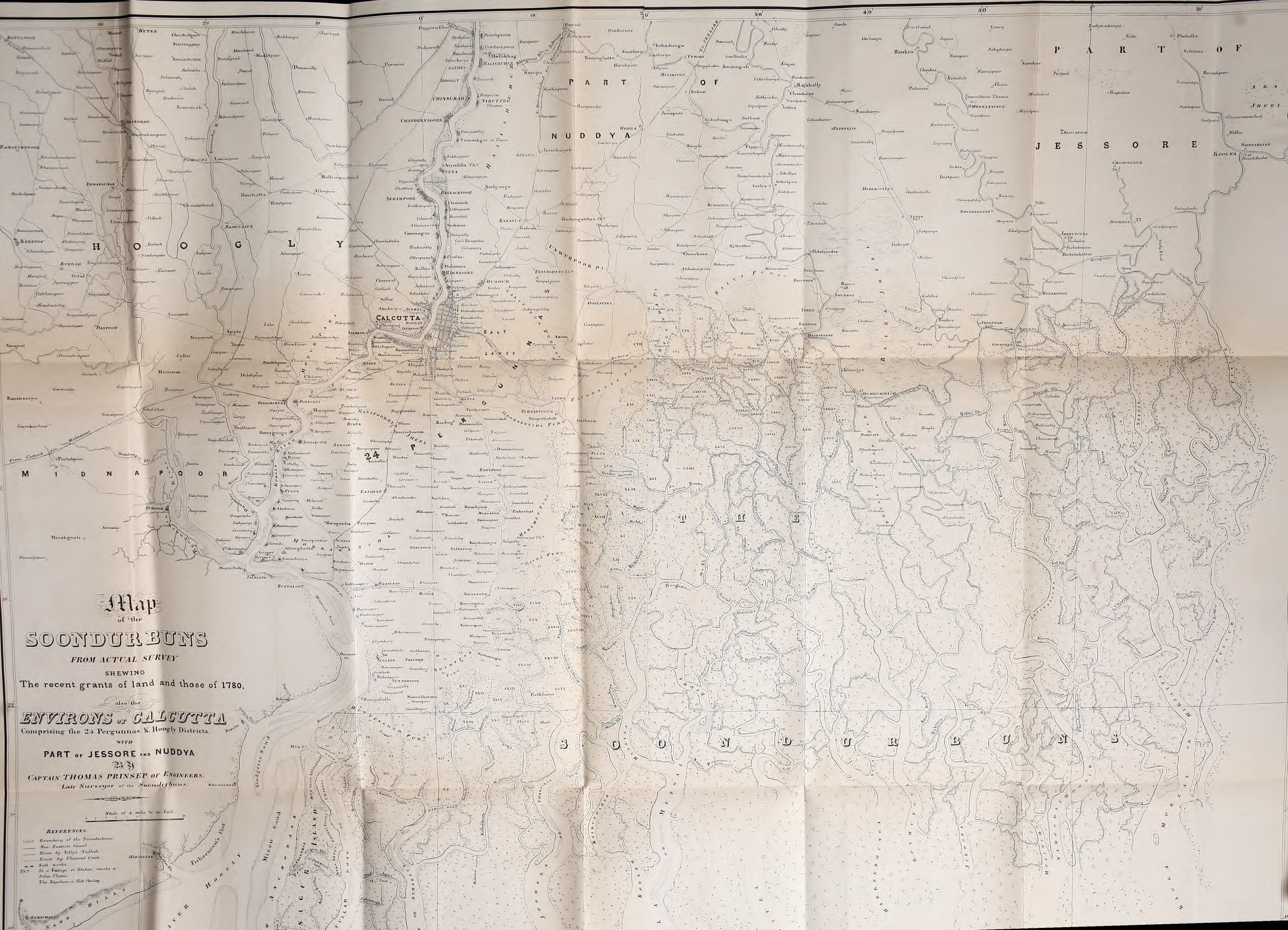
The quantity of daily rise and fall of the tides in the river Hoogly, differs very considerably during the neaps and springs, with a gradual and daily increase from the depth of the neaps to the height of the springs ; I have therefore thought it more concise to exhibit in a Diagram, annexed, the extremes of each state of tide, as observed in March and April for the dry season—August and September for the rains. In this Diagram the base of



Map
of the
SOONDURBUNS
FROM ACTUAL SURVEY
SHEWING
The recent grants of land and those of 1780.
also the
ENVIRONS of CALCUTTA
Comprising the 24 Pergunnas & Hoogly Districts.
WITH
PART of JESSORE and NUDDYA
CAPTAIN THOMAS PRINSEP OF ENGINEERS.
Late Surveyor of the Soondurbuns.

Scale of 1 mile to an Inch.
REFERENCES.
Boundary of the Soondurbuns.
Nac Eastern Canal.
Route by Telley Nullah.
Route by Channel Creek.
Salt works.
To a Village or Station marked a
Pole Thana.
The Numbers a Salt Choke.

References		References		References	
to the Principal Estates or Grants of 1780.		to the Principal Estates or Grants of 1780.		to the Principal Estates or Grants of 1780.	
1. Bagerhat	26. Bagerhat	XXXVIII. 1780	XXXVIII. 1780	XXXVIII. 1780	XXXVIII. 1780
2. Bagerhat	27. Bagerhat	XXXIX. 1780	XXXIX. 1780	XXXIX. 1780	XXXIX. 1780
3. Bagerhat	28. Bagerhat	XL. 1780	XL. 1780	XL. 1780	XL. 1780
4. Bagerhat	29. Bagerhat	XLI. 1780	XLI. 1780	XLI. 1780	XLI. 1780
5. Bagerhat	30. Bagerhat	XLII. 1780	XLII. 1780	XLII. 1780	XLII. 1780
6. Bagerhat	31. Bagerhat	XLIII. 1780	XLIII. 1780	XLIII. 1780	XLIII. 1780
7. Bagerhat	32. Bagerhat	XLIV. 1780	XLIV. 1780	XLIV. 1780	XLIV. 1780
8. Bagerhat	33. Bagerhat	XLV. 1780	XLV. 1780	XLV. 1780	XLV. 1780
9. Bagerhat	34. Bagerhat	XLVI. 1780	XLVI. 1780	XLVI. 1780	XLVI. 1780
10. Bagerhat	35. Bagerhat	XLVII. 1780	XLVII. 1780	XLVII. 1780	XLVII. 1780
11. Bagerhat	36. Bagerhat	XLVIII. 1780	XLVIII. 1780	XLVIII. 1780	XLVIII. 1780
12. Bagerhat	37. Bagerhat	XLIX. 1780	XLIX. 1780	XLIX. 1780	XLIX. 1780
13. Bagerhat	38. Bagerhat	L. 1780	L. 1780	L. 1780	L. 1780
14. Bagerhat	39. Bagerhat	LXI. 1780	LXI. 1780	LXI. 1780	LXI. 1780
15. Bagerhat	40. Bagerhat	LXII. 1780	LXII. 1780	LXII. 1780	LXII. 1780
16. Bagerhat	41. Bagerhat	LXIII. 1780	LXIII. 1780	LXIII. 1780	LXIII. 1780
17. Bagerhat	42. Bagerhat	LXIV. 1780	LXIV. 1780	LXIV. 1780	LXIV. 1780
18. Bagerhat	43. Bagerhat	LXV. 1780	LXV. 1780	LXV. 1780	LXV. 1780
19. Bagerhat	44. Bagerhat	LXVI. 1780	LXVI. 1780	LXVI. 1780	LXVI. 1780
20. Bagerhat	45. Bagerhat	LXVII. 1780	LXVII. 1780	LXVII. 1780	LXVII. 1780
21. Bagerhat	46. Bagerhat	LXVIII. 1780	LXVIII. 1780	LXVIII. 1780	LXVIII. 1780
22. Bagerhat	47. Bagerhat	LXIX. 1780	LXIX. 1780	LXIX. 1780	LXIX. 1780
23. Bagerhat	48. Bagerhat	LXX. 1780	LXX. 1780	LXX. 1780	LXX. 1780
24. Bagerhat	49. Bagerhat	LXXI. 1780	LXXI. 1780	LXXI. 1780	LXXI. 1780
25. Bagerhat	50. Bagerhat	LXXII. 1780	LXXII. 1780	LXXII. 1780	LXXII. 1780



Map
of the
SOONDUR BUNS
FROM ACTUAL SURVEY

SHOWING
The recent grants of land and those of 1780.

also the
ENVIRONS OF CALCUTTA
Comprising the 24 Pergunnas & Hooghly Districts.

WITH
PART OF JESSORE AND NUDDYA
BY
CAPTAIN THOMAS PRINSEP OF ENGINEERS,
Late Surveyor of the Soondur Buns.

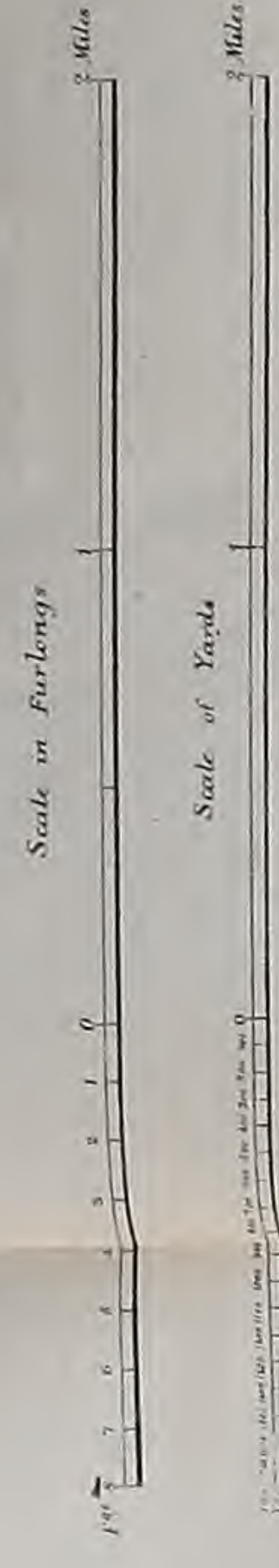
Scale of 4 miles to an Inch

- REFERENCES.**
- Boundary of the Soondur Buns.
 - New Eastern Canal.
 - Route by Tolly Nullah.
 - Route by Churn Creek.
 - Salt works.
 - To a Village or Station marks a Police Thana.
 - The Numbers a Salt Choke.

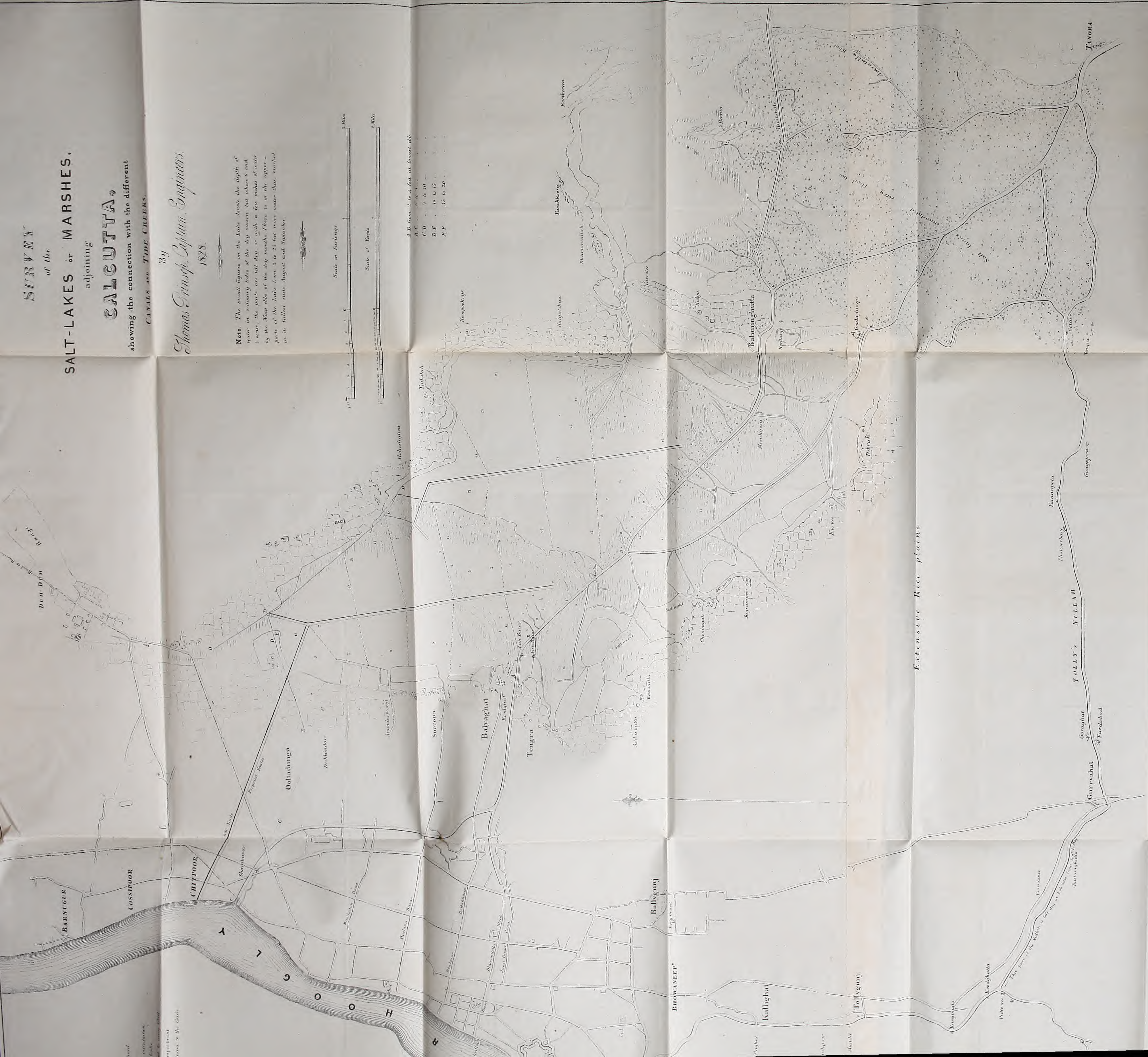
STRAITS
 of the
SALT-LAKES or MARSHES,
 adjoining
CALCUTTA,
 showing the connection with the different
 CANALS AND TIDE CREEKS.

By
Thomas Smith, Captain, Engineers.
 1828.

Note. The small figures on the Lakes denote the depth of water in ordinary tides of the dry season, but when it and 1/2 ebb, the parts are left dry or with a few inches of water by the Map this of the dry months. There is in the upper parts of the Lake from 2 to 25 feet more water than marked in the fullest state, August and September.



A. B. from 2 to 4 feet at lowest ebb
 C. D. 4 to 10
 D. E. 10 to 15
 E. F. 15 to 20



Extensive Rice plains

Section of the proposed method of silting the Lake by Compartments.



Note. The Eastern Trade, before 1773 approached Calcutta by the Lake to Badaghat or by the lower Sandakbar passage, emerging into Channel Creek. Major Tilly of Engineers proposed and executed on his own account under a grant of 12 years' privilege, the Canal having his name, uniting the old creek called Surman, which running to Koolghatta with the Tugra Lake at Koolghatta, and deepening a passage there which was I conclude then taken thence to Tugra, which passage then communicated with Burka River. The first excavations were small in Section, not 1 foot deep exceeding 50 feet in width. The Canal Enlargement of 1819, appears to have excavated both end of the Jungle land West of Tugra, which was formerly Lakes, the Salt brought by the influx of River water during the season through the Canals must have raised it to its present level, some five inches below high water mark.

(Signed) T. T. Parker Engineer, 20th Nov. 1828. 2. Lake
 (Signed) from a Day at the Lake, Engineers Office, Calcutta, 1828.

the system of levels is taken from the average surface of those parts of the Lake least subject to change.

The river Hoogly is found at its lowest mean level in January and February. It ebbs to its lowest extreme in March. In February the mean level of the river appears to agree with the mean level of the Lake tides, as observed in the Entallee Canal; the extreme variation of the former being 9 and 10 feet, while the extreme variation of the latter does not exceed 3 feet 2 inches. During the highest state of the two waters, in August [and] September the mean level of the Salt Lake is 4 feet below the mean level of the river. The extreme variation of the river being 13 to 14 feet, while that of the Salt Lake is only 18 inches. At this time of the year, the difference between the extreme high water mark in the river and that of the Salt Lake, is 11 feet; and the low water mark of the same tide will remain nearly the same in the river and Salt Lake.

This difference is found to vary as well at every period of each lunation, as at every period of the year. During the months of the greatest tranquillity, in January and February, the high water mark of the Lake tides will vary between 5 feet and 1 foot 6 inches below the high water mark of the river from the springs to neaps.

The low water mark of the Lake tides at the same time varying from 2 feet 2 inches, to 4 feet 6 inches above the low water mark of the river from neaps to springs.

During March and April, when the tides are at their *maximum* fury, the Salt Lake high water mark is frequently 8 feet below that of the Hoogly. The low water mark 6 feet above the low water mark of the Hoogly.

In the rains the high water mark of the Lake tides remains at from 5 feet, to 11 feet below the high water mark of the river.

6. Difference of high and low water mark in the Salt-Water Lake at Chaundpaul Ghaut?

7. Difference in point of time between high water at Chaundpaul Ghaut, and the western extremity of the Entally Canal, and Salt Water Lake?

The low water mark of the Lake tides being some times 2 feet below, at other times 1 foot above the low water mark of the river. The periods of high and low water in the Bidyadhuree river, from which the waters of the Lake are supplied, are rather before than after the same periods in the Hoogly.

From the peculiar nature of the Lake however, over which the tide spreads itself in its approach, and from which it receives an almost inexhaustible supply during its retreat, these periods are subject to great modification.

When the waters of the Lake are high, the daily variation of surface is small, (6 to 10 inches) and the period of high water in the Entallee Canal approximates nearly to that of the Hoogly.

When again the Lake waters are low, the daily variation increases, (to $2\frac{1}{2}$ feet extreme,) the tide is sluggish, and the period of high water in the Canal is found later than that of the Hoogly by upwards of two hours; and a person starting from the mouth of the Bidyadhuree river with the flood, may on his arrival, nine hours after starting, find the flood tide not yet expended, the distance being 28 miles.

The same causes influence the *maximum* and *minimum* influence of spring and neap tides upon the Lake levels, which are found to take place four days after each change; while in the river, generally, they take place the third and fourth tide.

8. Depth of water in the Entally Canal, and Salt-Water Lake, at low water?

At the extreme low water of March, there is from 4 to 5 feet of water in the Canal near the Koolga [Koolya] bridge. At the parts where the dredging machinery is at work 2 feet to $2\frac{1}{2}$ feet.

The parts of the Salt Lake immediately in contact with the navigable channel through it, (which is also its drain) are left dry at low water neap tides in the dry season. The parts more remote are never completely drained of water, and are scarce subject to a daily variation. I have

made an estimate of the bed of this part of the Lake in the Diagram attached, which I believe correct at an average.

9. Depth of water in the entrance of the channel into which the Salt Lake waters pass to Seaward?

The waters of the Lake do not pass immediately from the Lake, as a basin into a discharge canal, but gradually, and by myriads of little channels, empty themselves into a channel of five miles in length, which runs in a diagonal direction through the middle of its surface. In consequence, it is found that the rapidity and dimensions of this channel, which is likewise that used for navigation, increase in a settled ratio from almost perfect stagnation and dimensions given to it artificially at the Western extremity of the Lake, to what is much more than sufficient for every purpose of navigation at the Eastern end. At Bahminghatta the breadth is 150 to 200 feet, and depth at low water 15 to 20 feet, the current always rapid.

10. Original depth and width of Tolly's Nulla?

The dimensions of the two Natural Creeks, which were united by an Artificial Cut, excavated by Major Tolly, are not known. The Cut was probably 60 or 70 feet wide; the depth scarce lower than it is found at present, or level with what might have then appeared to be the low water mark in the Salt Creek running Eastward.

11. Present depth and width?

At present the bed of this Nulla is in the highest parts, upwards of 2 feet above the extreme low water mark of the river Hoogly. And in the neap flood tides of the dry season, there is found only 4 feet water for a length of 3 or 4 miles near Rasypugla; while in the ebbs, the same portion of the Canal is left with only a few inches of water.

12. What is the average silting up of Tolly's Nulla per annum?

This is unknown, from the original depth of the Nulla being required. There has probably been some near Rasypugla, while other parts of the Nulla have increased in section. The failure in my time of this part of the Nulla may however be accounted for otherwise.

Ditto of the Entally Canal and Salt Lake?

This Canal receives the rubbish and washings of the Streets of the Town from the drains of the Circular Road, besides which, its current is all but

stagnant at all times. It has been deepened twice since its original excavation in 1810, and I estimate the annual sediment along its bed at from 3 to 4 inches. I have no data to ascertain the sediment in the Lake itself. It is partial, and chiefly confined to the immediate neighbourhood of the channel through it.

13. Is the silting up of each, general, or confined to particular spots; and if the latter, the reasons why?

In Tolly's Nulla, if the failure of the part near Rasypugla, has proceeded from such cause, the reason may be, that the confined section of the Canal at this part, the narrowest throughout its course, offers a check to the colored waters introduced from the river in the rains, and causes the tide to deposit the great quantity of sandy particles which it holds in suspension. In the Entallee Canal the sediment must be general, but of course is greatest at the Western extremity, into which the drains immediately conduct.

14. How many acres are comprised in the Salt Lake, and unculturable marshes?

The Western Lake, the largest, contains about 18 square miles, equal to nearly 12,000 acres of land. The Eastern Lake may be taken at about 5,000.

15. Is the Salt Lake the property of Government, or individuals?

The right is, I believe, without question in favor of Government, but at present certain Zemendars claim and enjoy the rights of fishing upon the Lake, and think themselves at liberty to make encroachments upon its extent.

16. Has the mouth of the Tolly's Nulla on the side of the river been much cut away and widened by the rapidity of the descending current and by the flood tide?

I believe not at all; the contractions at the two old bridges of Kidderpoor and Allipoor, have too effectually checked the expenditure of water either way, but their contractions have by their eddies formed on each side of the bridge a kind of circular basin.

17. What is the level of the plain, general, as compared with the low water mark in the river during the rains?

The general plain of the lower Delta in the same parallel as Calcutta, is found to rise gradually towards the banks of the Hoogly, as also of every other fresh water outlet, which crosses it. The banks themselves being defended even against the highest flood. In the interior of the Delta, where the back water creeks alone intersect the country, and there is no trace of any former large outlet of the Ganges, the rice plains will be found nearly

upon a level with the low water mark of the Hoogly in the rains, and generally subject to an inundation of a few inches from the flood tides of the back water creeks during the spring tides of all seasons, if they were not embanked.

18. What is supposed to be the lowest level of any part of the Town of Calcutta?

The lowest part of Calcutta is the Mutchooa Bazar, nearly five feet below the extreme high water mark of the river. The Cantonment of Dum-Dum is about the same level.

No. I. (D) (*Continued.*)

No. 4. (*ditto*)

LEVELS.

The lowest part of Calcutta corresponds with the 18 feet mark on the Tide Map of the Hoogly.

On the 9th, 10th, and 12th of July . . . Four double tides, days and nights, were higher than 18 feet.

22nd, 23rd to the 29th inclusive . . . Eight double tides were. . . ditto.

August 5th to the 12th, inclusive . . . Eight double tides. . . ditto.

——— 19th to 27th. . . . Nine ditto, . . . ditto.

September 3rd to 10th. . . . Eight ditto, . . . ditto.

———— 18th to 26th. . . . Nine ditto, . . . ditto.

Total——46 double tides higher than the lowest part of Calcutta.

In July they would be two hours each tide, and in August and September three to four hours at the utmost, above the lowest part of Calcutta.

The ebb during these high tides is about 9 feet which is a fall, every low water, to about 6 feet below the lowest part of Calcutta.

During the year 1823, there was an inundation of the Damoodah, on which occasion, the tide did not ebb below the lowest part of Calcutta for nearly three complete days and nights.

No. I. (D) (Continued.)

No. 4. (ditto)

LAND LEVELS.		TIDE LEVELS.	
	feet.		
Highest Level. Strand Road near Mint. ———	20—		
	19—		
	18—		
Roads near Government House. ———	17—		
	16—		
	15—		
Stone at Chandpaul Ghaut. ———	14—		
	13—		feet. inches.
	12—		13 2 Highest rise of the Hoogly—August, September.
	11—		
	10—		
	9—		
Lowest part of Calcutta—Mutchooa Bazar. ———	8—		3 Spring floods of March, April, May.
The rice plains north of the lake have a surface sloping gradually towards the Lake from about the mark 7 feet to 1 foot. ..	7—		7 1 Neap floods in the Hoogly in August.
	6—		
	5—		
	4—		
The floors of the present Town Drains along the Circular Road stand between the 5 feet 1 inch and 2 feet 1 inch. ———	3—		
	2—		0 Highest Lake and Canal tides, August, September.
	1—		0 Neap tide floods in the Hoogly—March.
	0—		
Believed lowest bed of the Salt Lake. ———	1—		3 Ordinary high water mark in the Lake & Canal—March.
	2—		
	3—		9 Lowest observed neap ebb tide in the Lake and Canal.
	4—		
	5—		4 Neap tide ebbs in the Hoogly—March.
	6—		
	7—		5 Lowest spring tide in the Hoogly—March.
	8—		

No. I. (E)

No. 5.

Tables exhibiting a Daily Register of the Tides in the River Hoogly, at Calcutta, from 1805 to 1828 ; with observations on the results thus obtained.—By James Kyd, Esq.*

Territorial Department. Revenue. Consultation,
16th Feb. 1830, No.—

Having kept a Register of the day and night tides in the Hoogly, at Kidderpore, near Calcutta, since the year 1806, for which the nature of my business, and my establishment afforded me facilities, and the permanency of my gage fixed at the dock head, rendering the results correct, beyond suspicion or doubt—I am induced to lay them before the Society,* trusting that they may prove interesting.

[* Asiatic Society.]

To avoid the dry detail of a daily Register, I have drawn the heights of the tides in maps, shewing the state of the river throughout the year, conveying at a glance, all that is requisite to be known for every useful purpose.

The Map No. 1, is made for the year 1806-7, and I have upon the same Map, traced the tides for the year 1825-26. The phases of the moon in the latter year falling nearly on the same days, and thus enabling me to give two years together, and to shew the variation between them, at a distance of nineteen years.

Map No. 2, is similar to the first in principle, but has been chosen to shew three distinct inundations, that took place in the year 1823. The first of which was occasioned by the sea, and the second and third by the *Ganges* and *Damoda* rivers. The first was a very rare occurrence, happening not oftener, perhaps, than once in a century; the last nearly as rare, but the second occurs every sixth or seventh year.

Map No. 3, consisting of twelve parts, one for each month, is a daily and nightly record of the river, for the said remarkable year 1822-23.†

Map No. 4, gives a comparison of the range of high, and low water for successive years, from 1806 to 1827.‡

† Query,—1823-24,
Vide Map No. 4.
J. M.

These tide-tables, formed from a Register kept for twenty-two years, establish, beyond dispute, the lowest fall and the highest rise of the Hoogly, and thus form natural points for the construction of a River Gage, for the purpose of obtaining, at all times, the levels that may be required for the formation of canals, docks, wharfs, and drains. They also shew the height of the river at all times of the year, a matter of considerable importance in the formation of public works, especially as the variation is so great, at its different periods.

I shall now advert to the local causes which affect the tides in the Hoogly. The maps commence with March, in the beginning of which the south-west monsoon sets in. With the south-west winds, the currents set up the Bay of Bengal, and gradually raise the sea, at its head, several feet, raising with it the Hoogly, long ere the freshes are felt.

* ‡ NOTE.—Registers of subsequent years have since been obtained by the Municipal Committee—Vide Map. No. 4.—J. M.

The dotted curve line in Map No. 1, will shew this rising of the sea, and river by the wind, and currents. This cause continues till October; the pouring of the rivers into the Bay of Bengal, during the months of August and September, and the change of wind at the end of October, give the currents a set in the contrary direction, and gradually restore the sea and the river to the state they were in, in March.

The effect of the two monsoons upon the currents, and the height of the sea, in the Bay of Bengal may, therefore, be considered as that of two long unequal tides, during the year, eight months of flood, and four months of ebb.

In conformity with these periodical local causes—partial ones have a corresponding effect, thus strong southerly winds raise the tides in the Hoogly, whilst northerly ones depress them.

The freshes, or floods of the rivers, are a prominent periodical local cause, operating upon the tides of the Hoogly at Calcutta.

The Ganges begins to rise, from the melting of the snow, as early as the beginning of May, but its rising does not sensibly affect the Hoogly till the beginning of July; at that period, so large an accession of water is thrown into the Hoogly, that its level is bodily raised both at high and low water. The last is so remarkable, that the low water of the freshes (neap tides) is higher than the high water (neap tides also) of the dry season, by several feet.

The *Damoda* and western small rivers, or mountain streams, contribute very materially to the swelling of the Hoogly, and it is, probably, the influence of the *Damoda*, the *Rúpnarain*, the *Tongoracolly*, the *Hidgelee*, and even the *Balasore* river, (the latter situated beyond the mouth of the Hoogly,) that occasions the height of the low water, by their acting as a dam, and preventing the ebbing of the waters from the Ganges, and higher streams, quickly into the sea.

There is another local affection of the tides, the cause of which I cannot satisfactorily explain. In the north-east monsoon, the night tides are the highest, whilst in the south-west monsoon, the day tides are the highest.

A conjecture may be hazarded that as, in both monsoons, the wind is generally higher during the day than in the night, that the wind in the south-west monsoon raises the day tide; whilst in the north-east monsoon the wind, during the day, withholds and depresses the day tide; but this is not entirely satisfactory, in as much as the wind cannot possibly be uniform, whereas the fact of the higher tides during the day in one monsoon, and during the night in the other, is beyond doubt; besides, the latter is very much more than the former, being as much as two feet, whereas the former is seldom more than one foot. The night tides in the north-east monsoon are also more uniform in this respect than the day tides, in the south-west monsoon.

Should it appear from future observation that the wind be the cause, it will prove that the depressing effect of the northerly wind, has much more influence upon the tides, than the increase by the southerly ones; or it may be, that the absence of the wind leaves the tide more freedom to act.

I come now to general causes.

The horizontal parallax of the moon invariably affects the tides; when that is high, the tides are high, and vice versa, to such a degree of correctness, that allowing for local causes, I could venture to construct a table for a year in advance, that should not vary two inches, from the actual tides.

When the parallax is highest, on the second, or third day, after the full or change of the moon, the highest tide will correspond with these days, as that is the natural period of its greatest height; should the parallax be low and decreasing, the highest tide will be on the day of the full, or change; and should the parallax be decreasing, and near to its lowest, and increase again, after the natural period has passed, the highest tide will be on the fourth day, after the full or change of the moon.

The difference of effect between the high or low parallax of the moon, upon the height of the tides, is about two feet, frequently much more; and as its variation, as to the time, is shown to be four days, this is of importance to all mariners, as enabling them, in cases of danger, to ascertain by their Nautical Ephemeris, the true state of the tides. No longer need they trust to the partial observations and equally partial theory founded thereon, of Pilots and Seamen, most of whom have a notion that the dark spring tides are always the highest, that the night tides are higher than the day tides, and that the highest-tide must always occur on the second or third day after the full, or change, whereas the parallax of the moon will effectually supercede this uncertainty, and either warn a mariner with his bark on a shoal not to wait till the second day, and lose the springs, or save him from despair, because these days may have passed, and induce him to wait with confidence till the fourth day, after the full, or change, for the highest tide, as the case may be.

The parallax of the moon will assuredly indicate the height of the tides all over the world; this general cause, therefore, must be applicable at all places.

The following abstract will be useful, as conveying a general summary of the tides of the Hoogly.

From the point of lowest low water in the dry season, to that of the highest high water in the freshes, is twenty feet ten inches.

The greatest mean rise of tide from low to high water mark takes place in March, April, and May, and is fifteen feet ten inches.

The greatest mean rise of tide from low, to high water mark, in the freshes, is ten feet.

The smallest mean rise of tide takes place in the freshes; and is, at neap tides, only three feet six inches.

The smallest mean rise of the tide in the dry season, neap tides, is four feet.

From the lowest fall of the river, to high water mark, neap tides, in February, is eight feet.

[Ditto, spring tides is twelve feet.]*

From the lowest fall of the river to low water, in the freshes (neap tides,) is twelve feet.

[Difference between the lowest high water spring tides in the dry season and the highest high water in the freshes is eight feet ten inches.]

The river is at its lowest, in the beginning of March.

The river is swollen by the freshes in July, August, and September, and part of October.

The freshes take off about the middle of September, and are generally out of the river, by the end of October.

NOTE.—The matter within brackets is what has been added in MS. to Kyd's printed Tables, by the late Mr. A. H. Blechynden, by whose son the Municipal Committee were favoured with a copy of Kyd's Tables, and from which the present ones have been printed.—J. M.

* During the inundation in September, 1823, the low water stood at eighteen feet six inches, the tide having ebbed only fifteen inches on that day. The difference between this low water, and the high water (neap tides in February; viz. eight feet,) is ten feet six inches!!

At the beginning of November, although the freshes are out of the river, it is upwards of three feet higher at low water, than in March.

The river is in the most quiescent state during the months of November, December, January, and February; during these months, the night tides are higher, and more rapid than the day tides, and there are, on some occasions, bores at night.

The strongest flood tides, and the greatest mean rise of the tides, are in March, April, May, and June. The day tides in these months, are higher than the night tides.

The strongest freshes are in September.

In July, the strength of the flood tides is counteracted by the freshes, and this, therefore, is a moderate month, as regards tides. The bores also are moderated as a consequence.

In August, the flood tides are overcome by the freshes, and the bores are moderate; should there be a high parallax of the moon, however, the great height of the sea, in this month, will cause a considerable bore.

In September, the freshes are at their height; there is no visible tide off Calcutta, the ships do not swing up, and the river water is perfectly sweet, far beyond Saugor in the open sea. The high parallax of the moon at the equinoxes, with the great height of the sea, produces a heavy bore in this month.

The Bores.

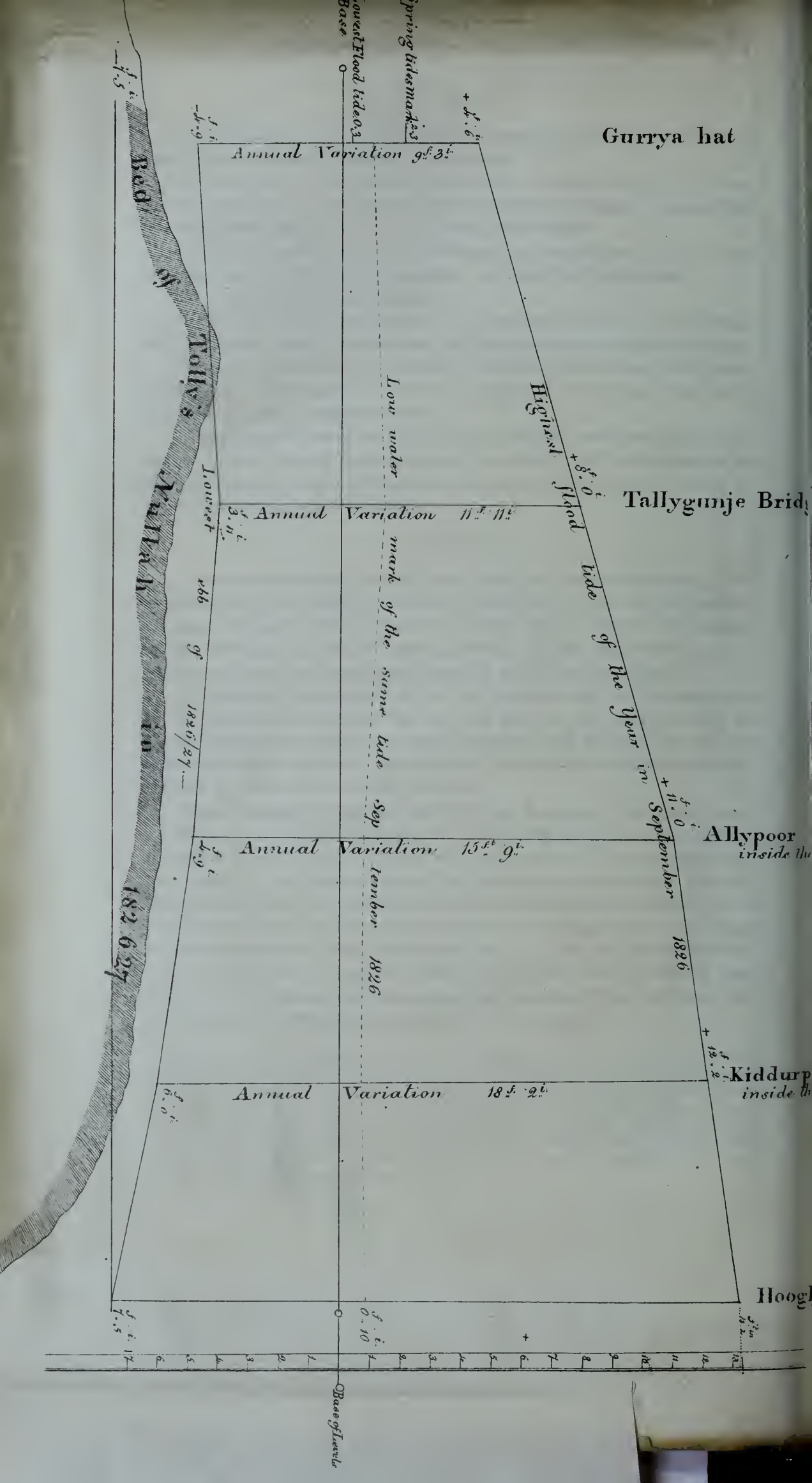
The bores in the Hoogly occur only on the highest, or at alternate spring tides; their appearance may, with certainty, be predicted by the season of the year, and the parallax of the moon. During the months of November, December, January, and February, or on the periodical ebb of the sea, when the currents are setting down the Bay, the tides, as may be supposed, are languid, and consequently, during this period, there are no bores.*

As soon as the south-west monsoon sets the currents up the Bay, the sea begins to rise, the tides become strong and high, and bores follow in their train; whenever the parallax of the moon is high on the springs during the south-west monsoon, bores will certainly make their appearance, and when strong southerly winds are added, and freshes withheld, the height of the bores will be increased.

It must be remembered that the height of the bore, is actuated by the peculiar form of the sands, and the direction, and set of the tides, in any particular reach of the river; for instance, where the channel is straight, with deep water, from side to side, and no sand-bank, there will be no bore at any time; but a mere swell on the coming in of the tide. This is the case at the lower part of Garden Reach, opposite the Botanic Garden. This is the case also off Calcutta, at Howrah Ghaut, where the back channel having lately filled up, the main channel is now confined between high banks. It is only where the main channel lies on one side, with a low sand on the other, that the bore shews itself upon the latter. This, a very few years ago, was the case opposite to Calcutta, and there was, at that time, an enormous bore, but which, as above explained, exists no longer.

* Except very rarely.—In twenty-two years I have known but three instances. Agreeably to the Statement of local causes which accelerate or depress the tides, it will be obvious that during the north-east monsoon, if the winds which blow the waters down the Bay, be more than usually moderate, and the moon's parallax be high, there may be a high tide, and with it a bore, and this, agreeably to the third local cause, will happen at night. These night bores are particularly dangerous, as they are very rare, and consequently, unexpected. They may be guarded against, by always considering it possible for them to occur during the north-east monsoon at night, upon a high parallax of the moon. Agreeably to the same local cause, it is fortunate that the bores at night, during the south-west monsoon, are not so high, as in the day.

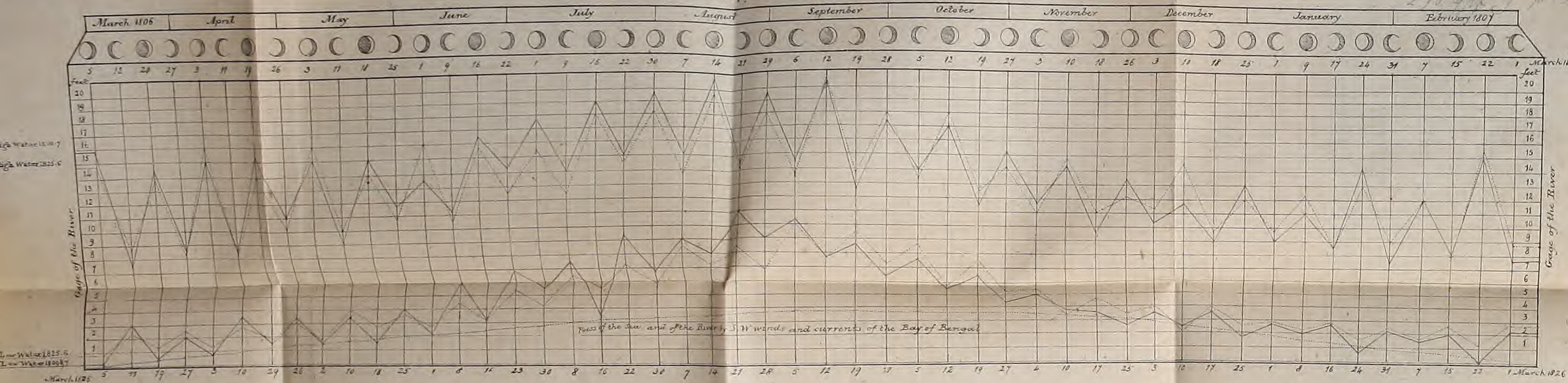
Hoog



SHEWING THE HIGH AND LOW WATER OF THE RIVER HOOGLY AT CALCUTTA

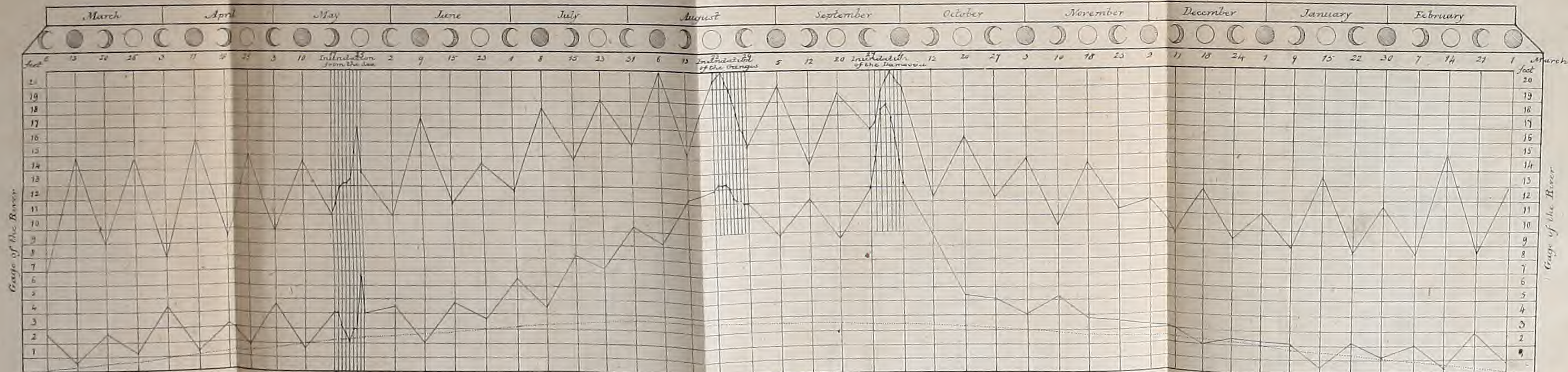
In Spring and Neap Tides during the years 1806/7 to 1825/26

Map N^o 1



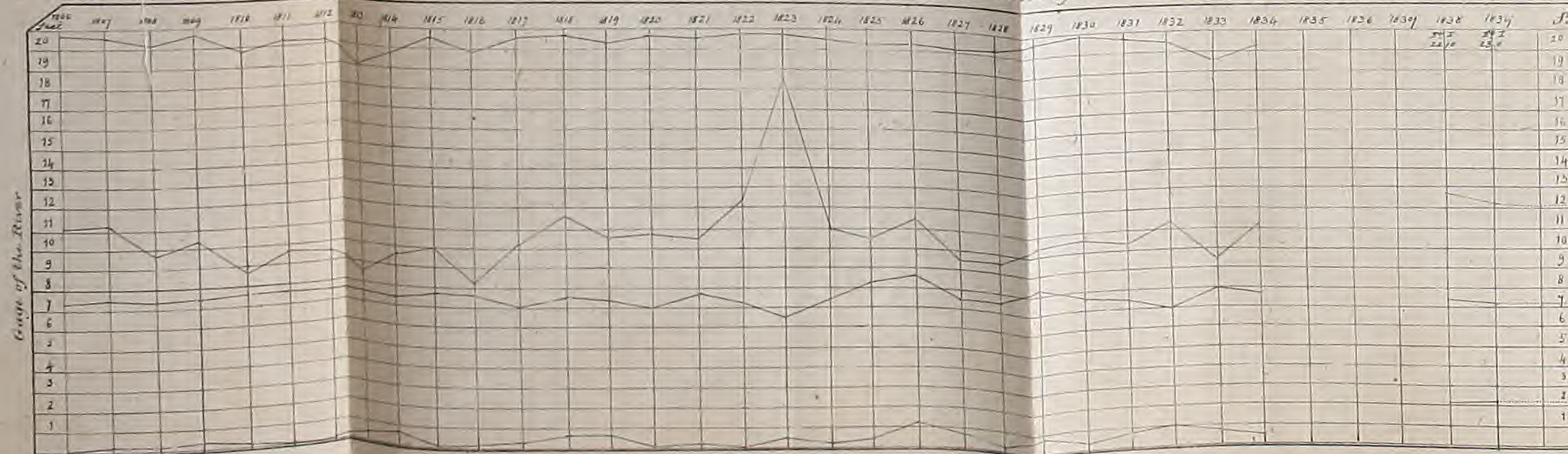
Map N^o 2

Showing the High and Low Water of the River Hoogly at Calcutta in Spring and Neap Tides during the year 1823/24.



Map N^o 3

Showing the high and Low Water of the river Hoogly from the year 1806 to 1830.



- A Highest High Water, being the highest rise of the River, Spring Tides during the Freshes.
- B Highest Low Water Neap Tides during the Freshes.
- C Lowest High Water Neap Tides during the Dry Season.
- D Lowest Low Water Spring Tides during the Dry Season.

Note. The Registers of the High & Low Water of the River Hoogly from 1825 to 1834 inclusive have been taken from a Table by the late Mr. Ryd in the possession of Mr. Blichindere. The Registers for the years 1831 and 1839 have been obtained from the Superintendent of the Hyderabad Dock who states that he is not able to furnish the Registers for the years 1835 to 1837 inclusive owing to the Registers of those years having been mislaid.

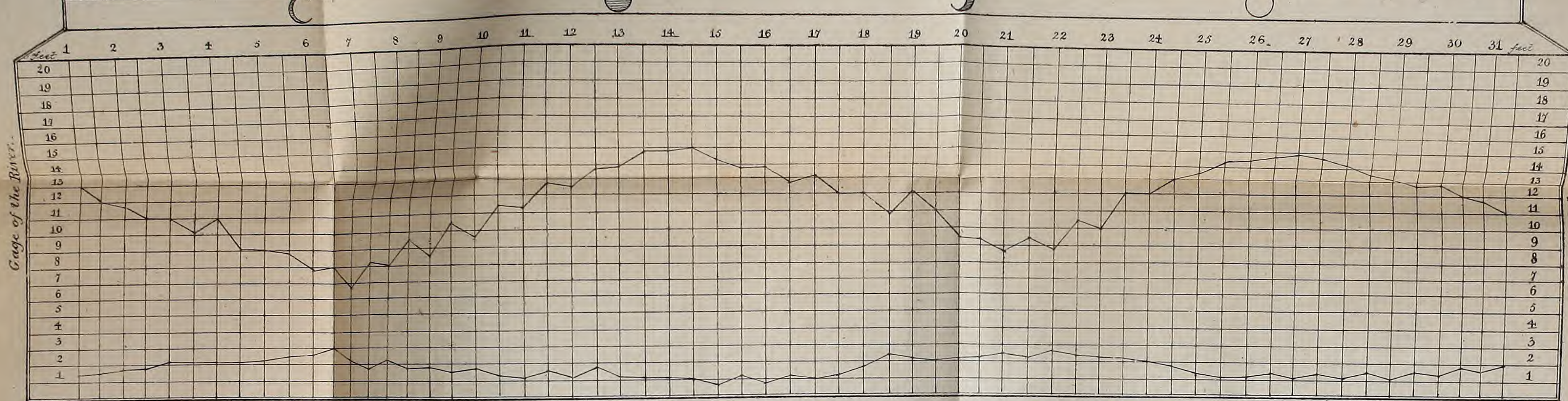
Spring
House
Base

SHEWING THE HIGH AND LOW WATER OF THE RIVER HOOGLY AT CALCUTTA

in the Month of March 1823.

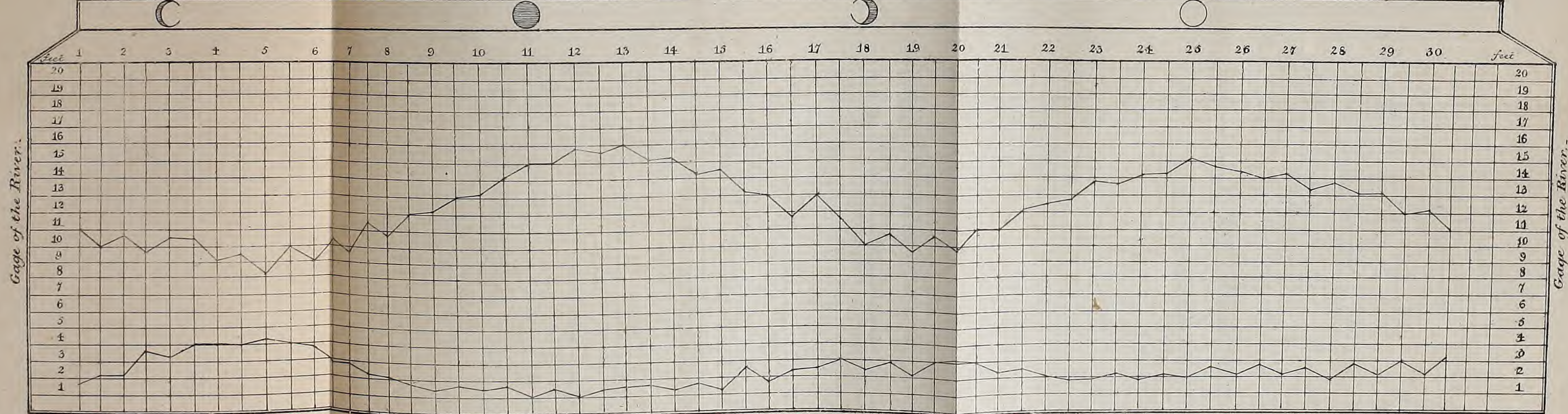
270 41.5 115

Part 1st



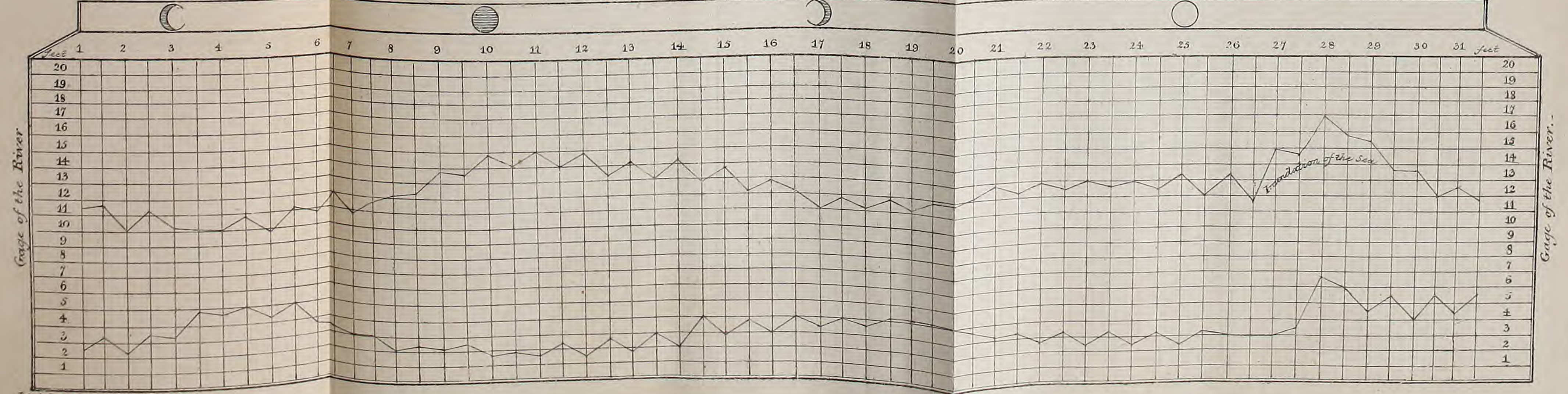
Part 2nd

April 1823



Part 3^d

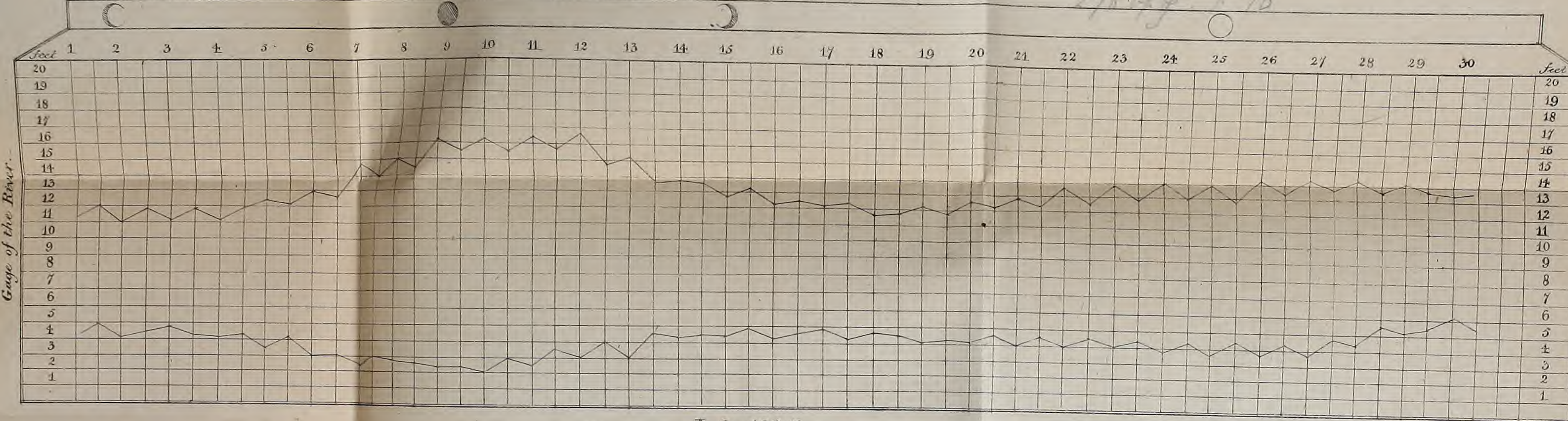
May 1823





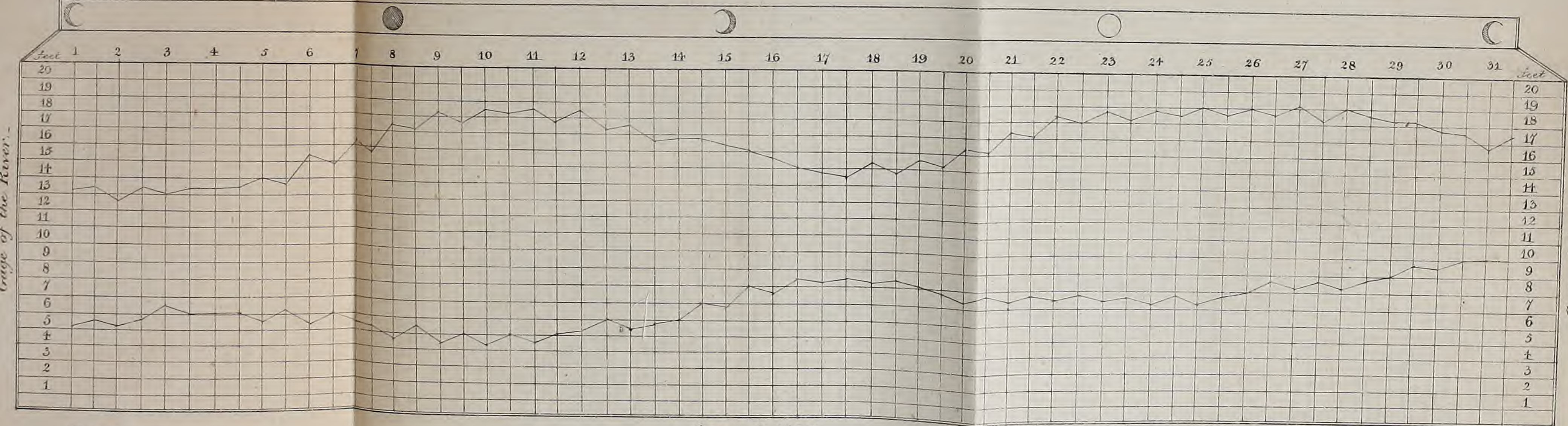
Part 4.

270 248 16



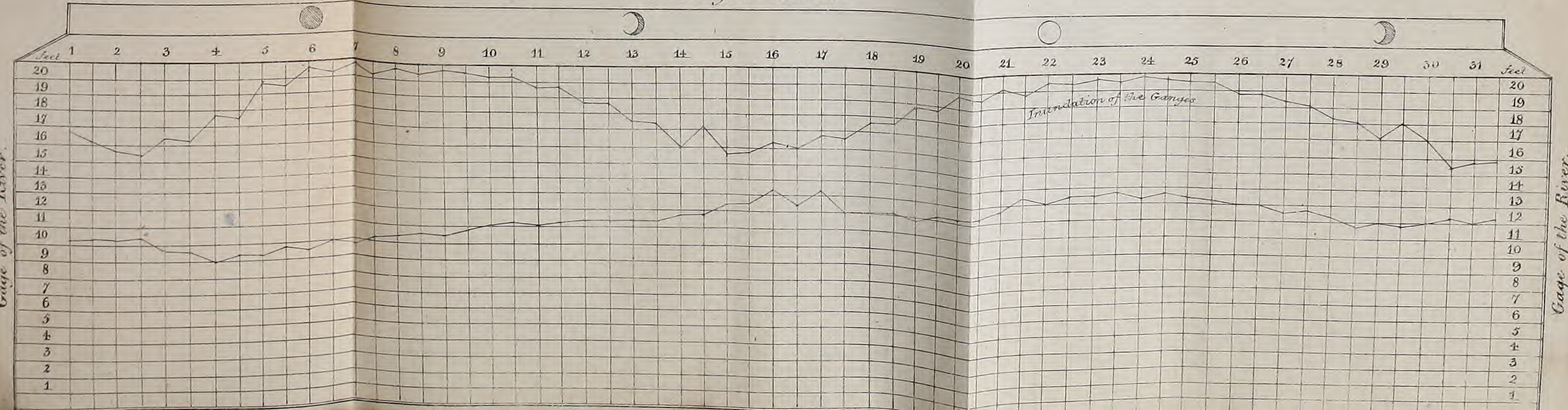
July 1823.

Part 5.



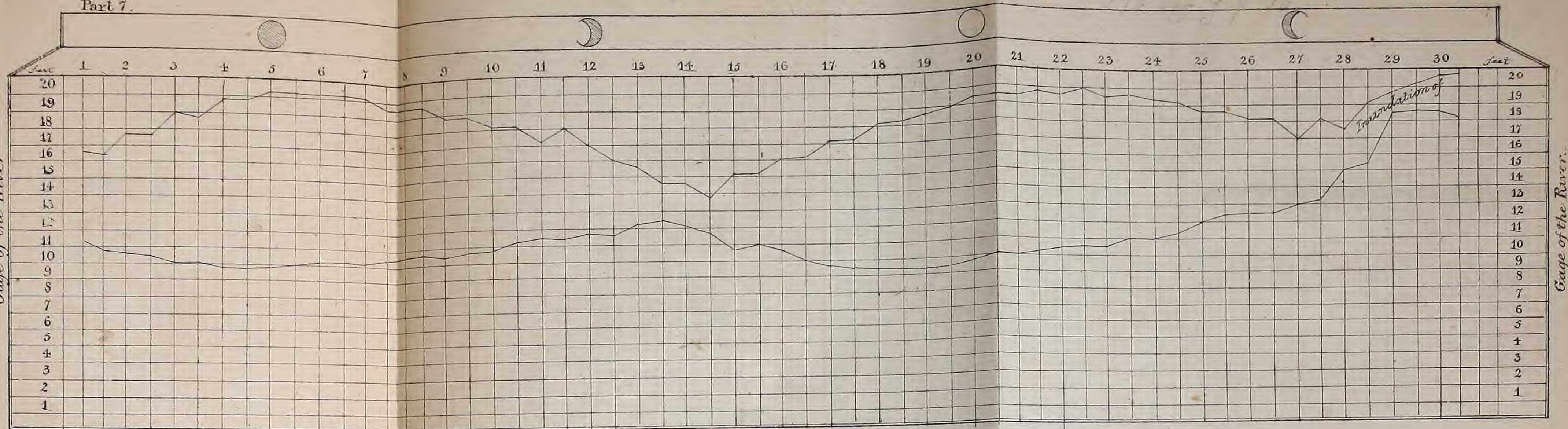
August 1823.

Part 6.



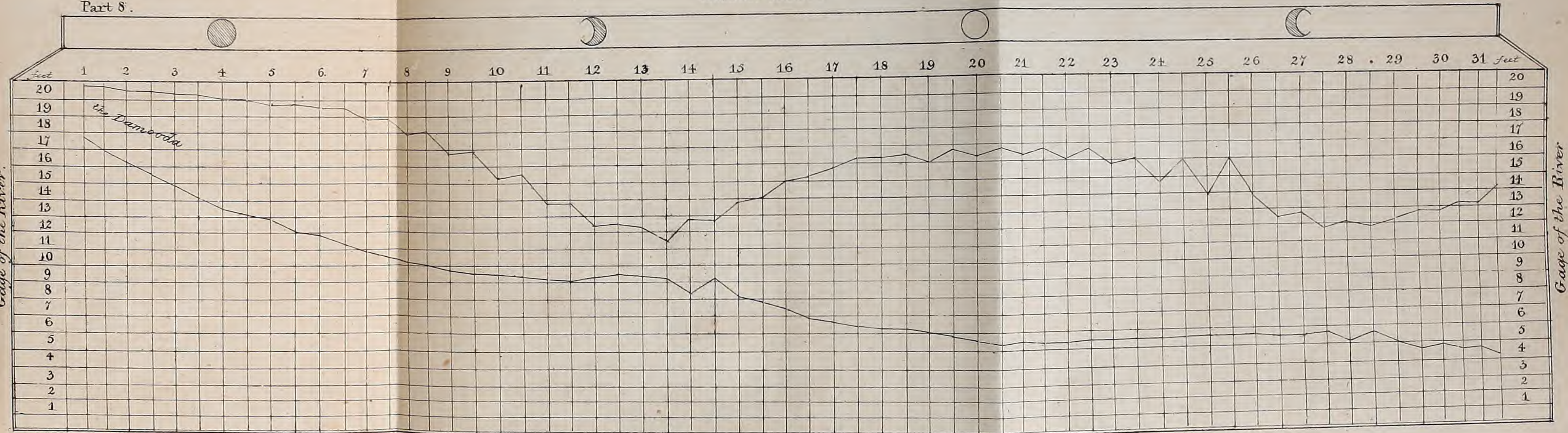
Map 3^d Cont^d
in the Month of Sept^r 1823.

Part 7.



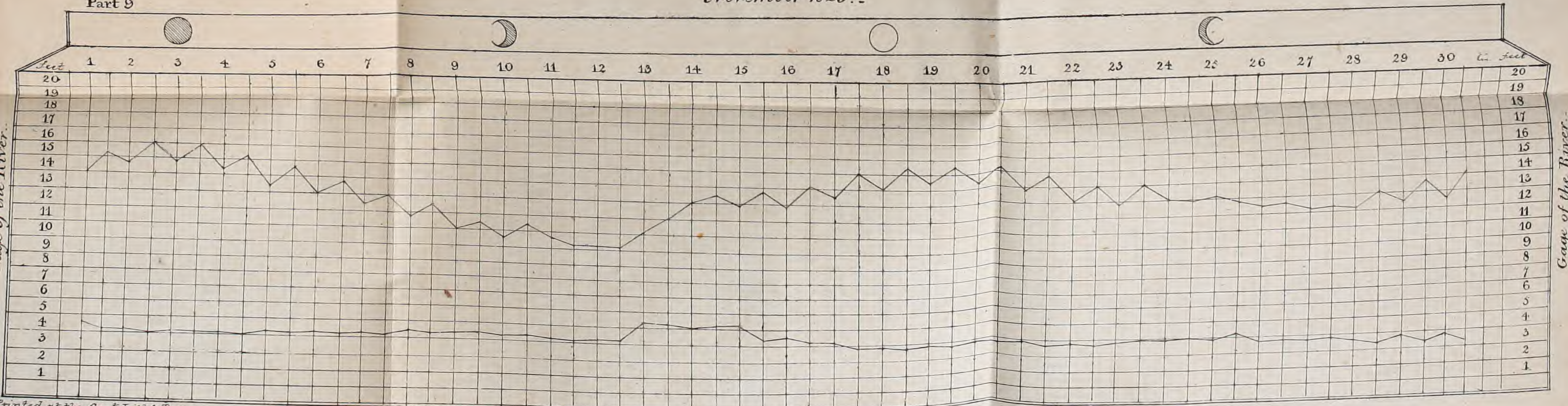
October 1823.

Part 8.

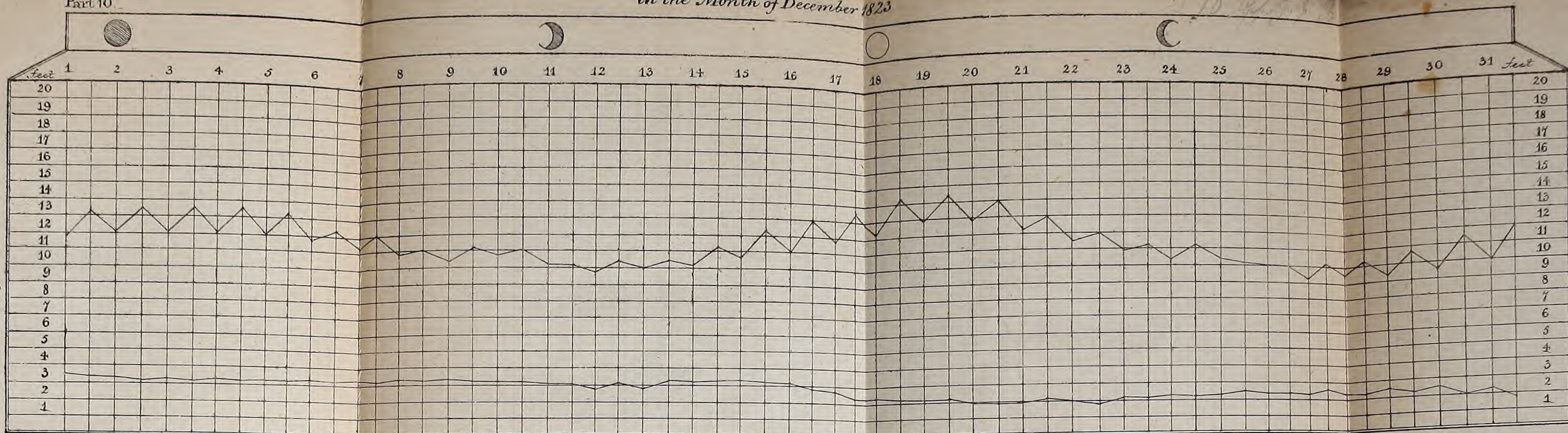


November 1823.

Part 9

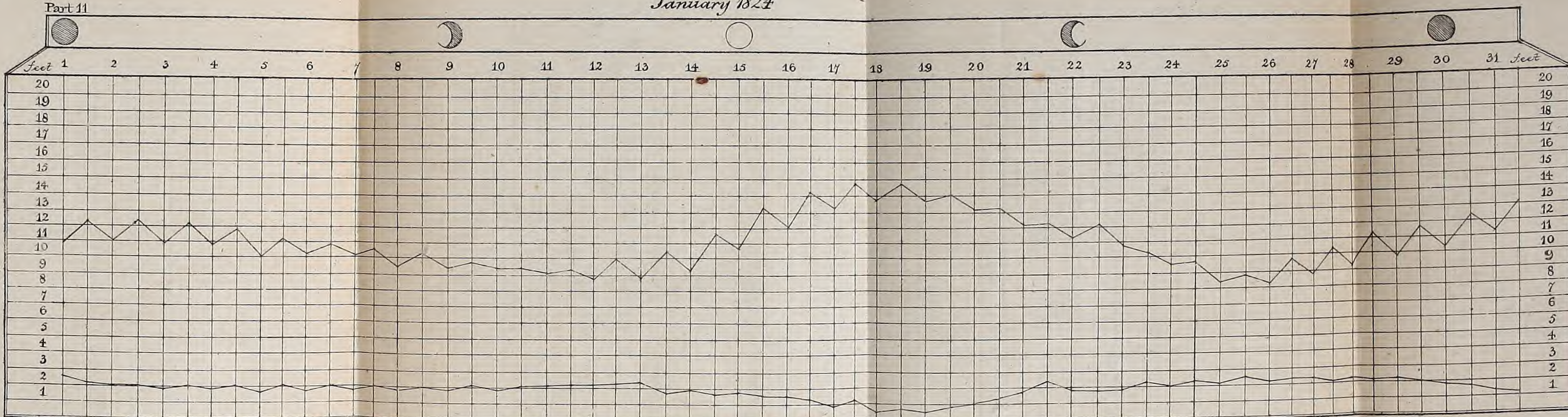


Gage of the River.



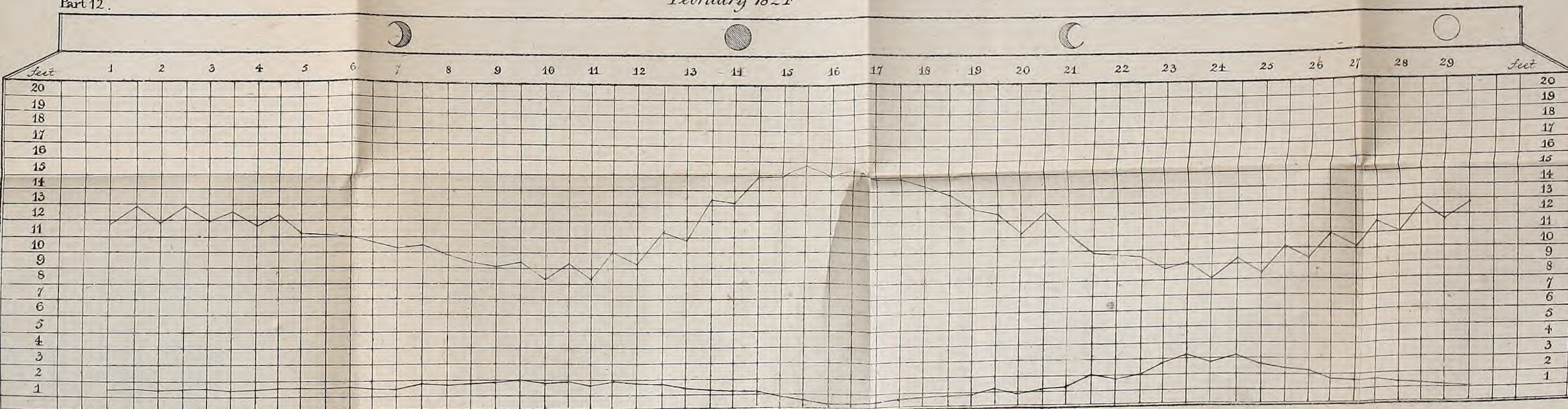
Gage of the River.

Gage of the River



Gage of the River.

Gage of the River.



Gage of the River.

No. I. (F)

No. 6.

Capt. Prinsep's Memorandum and Diagram on Tolley's Nullah.

Territorial Department. Revenue. Consultation,
16th Feb. 1830, No. 9

The narrowest part of this Nulla, about midway between Tollygunge and Gurryahaut, has a width of between 50 and 60 feet at high water, and is left dry at the low ebbs of the dry season.

The levels in the accompanying Diagram have been assigned from continued observations upon the daily tides and annual variation at the respective places. Those of Gurrya have been connected with the instrumental levels of Captain Taylor as nearly as they could be; but Captain Taylor's levels of 1823 fix the annual variation at Gurtya at 8 feet 5 inches—so that the removal of the several wooden bridges had, as early as 1826-27, caused an increase of 10 inches in the annual variation at that place. During 1827-28 the annual variation was still 9 feet 3 inches.

The line drawn for the bed of the Nulla has been taken from the known floors under the several bridges. There is in general a greater depth of water in the space between the bridges, forming a kind of pool in which boats remain afloat during ebb tides. The best harbour of this kind is between Allypoor bridge and Tollygunge.

During the spring tides of July to October, there is no reflux from the Soonderbuns at Gurrya, from the influence of the freshes in the river Hoogly. During the dry season the tides of the Hoogly generally meet those of the Soonderbuns in some place between Tollygunge and Gurrya; the ebb towards the Soonderbuns being still superior in force to the ebb towards the river.

No. I. (G)

No. 7.

Capt. Prinsep's Memorandum on the Salt-water Lakes, in the vicinity of Calcutta; with suggestions for filling them up by Warping.

Territorial Department. Revenue. Consultation,
16th Feb. 1830, No. 10

The position of an European city of such importance as Calcutta, upon the very borders of an extent of Salt Marsh of which the insalubrity is so generally acknowledged, has often awakened the surprise of intelligent strangers; nor is it easy to adduce reasons why the recovery to cultivation of so large a tract has not, before the present moment, become an object of consideration to an enlightened Government resident on the spot.

The inhabitants of the factory of Calcutta might with some reason have looked for security in the proximity of an immense impenetrable morass upon their flank, and as a defence against cavalry marauders, would endeavour with jealous care to preserve it in the state it was. But the residents in the Capital of an Empire, which has no enemy in

the field within 1500 miles; must view it in a different light. Health and appearance have long taken the place of security and defence as objects to be kept in view in the local improvements of the City and its vicinity; and there is only one way of accounting for the subject having escaped attention, which offers any probability of truth. It would seem that the idea of the Lake being necessary to the military defence of the city, has been succeeded by an impression, not altogether unfounded, and which appears yet to be rather generally entertained, viz., that the existence of this Salt Marsh in its present state is indispensable to the perfect Drainage of the City.

Upon this point then it is necessary to be most particularly informed before any measures are proposed, that would interfere in any way with the present system, whether that system be effectual or otherwise. I shall offer my observations upon this point in the first instance, and hope to place the subject in such a light, that its reference to any scheme connected with the City, will be at once comprehended.

The River Hoogly, the western boundary of the Delta of the Ganges, as well through its connection with the great river as from the streams flowing into it from the west, is subject to annual permanent freshes, commencing in June and terminating in October. In the centre expanse of the Delta there are likewise several streams, having connection with the Ganges, which are subject to the same influence—rising at the season named, according to the quantity of influx of fresh water from the Ganges.

The surface of the Delta intervening between these is divided into a perfect labyrinth by tide back-water creeks, which are subject to no other change of level during this season, than what is derived from the vicinity of the great discharge of water from the *embouchures* of the great river, and the effect of this discharge upon the tides in the upper part of the Bay of Bengal, added to the trifling discharge of rain water upon the surface of the country, immediately in contact with the creeks.

Calcutta is situated on the Hoogly, below the parallel of latitude to which these tide back-waters are found to run; for in the general slope of the surface of the Delta from its upper fork at Jellingee, to the sea, there is of course a limit beyond which the tide influence could not extend. And this City, built along the coast of the high banks of the River, which are generally above the elevation of its highest known flood, has immediately behind it an expanse over which the tides of their back-waters spread—thus dissipating part of their force and elevation.

I may mention here, that it is a general principle of these Creeks, that they either possess at their upper termination a jheel of this nature, over which they spread and dissipate their force, or else when they are connected with a continued channel, receiving some little water from the great river; the tide in its run up a long continuous channel, gradually spends itself by the length of its course and friction of the bed.

It is a question of some difficulty in Hydraulics to determine the level of the surface of the highest and also mean-tide level of these jheels, or what may be called the point of dissipation of the creek tides relatively with the summit level of the tides of the Bay from which they are fed, and when I hazard the assertion that the point is below the summit level of the parent tide even at the distance of 70 miles from the sea, which I believe is the case universally, I naturally do so with some caution, as the subject has not been considered by any mathematical writer upon the subject of Tides.

It is not my purpose to enter more particularly into the reasons that have led me to such a conclusion in this place.

The Jheels above mentioned, and the Salt Lakes in the present case, from their depression below the general surface of the country, naturally become the receptacles of all its superfluous water; and where the supply is considerable, the general level of the jheel, as also of the creeks which run up into it, is influenced in proportion during the season of such supply. In no case however does there exist a rise from such cause at all in proportion to the influence in parallel latitudes of the permanent freshes of the great river, when admitted into a branch like the Hoogly. The effect of such supply creates a general slope of the surface of the Lake or Jheel proportionate to the expenditure required; and in the creek, which is the outlet of the Salt Lake for this expenditure, the summit level is found very little (not 1 foot) above its extreme summit level in the dry months, when only the tide enters it; and the discharge is then effected by an inequality in the duration of the flood and ebb, in the same way that the fresh water of a river is carried off. The supply of fresh water which now enters the Salt-water Lakes, is found to raise its mean surface towards the centre or opposite Balyaghat, two feet.

This level is however, which would not be at first supposed, still below the summit level of the tides of the sea.

I have made the above remarks to explain particularly the nature of these back-water creeks, because in case of the removal of the lakes by their being filled up or embanked against the tide, and when a canal connected with these creeks is brought in circuit round one-half of the City to be drained, it is essential to know what will be the state of the tides under these new circumstances. Indeed the whole question of the expediency of recovering the Lake for agriculture, as well as the means to be adopted for the purpose, will turn much upon this point.

The first case to consider is—by the removal of the Lakes, and substitution of a closed Canal, as above described, to Chitpore—what would be the effect upon the present tide levels at Tarda, below the confluence of the Lake outlets and Tolly's Nulla? Also to assign the position of the summit level of the present Tarda tide upon our general tide gauge.

Upon the general principle that the extreme level in a creek, nearer the parent tide, must be above the highest surface in the lake, of dissipation, when there is no foreign supply of jheel or rain water, and no supply into this Lake, but direct from the sea by this creek; I have supposed, that the present extreme tide at Tarda in the dry season, April, May, is nearly the mark $+1$; while the highest level near Balyaghaut is at Θ , and that the extreme levels at Tarda, and in the centre of the Lake during the rains, nearly correspond at $+2$. Upon like reasoning it may be shewn, that by withdrawing the influence of the Lakes the extreme level at Tarda will be raised a little, but as the tide will have a lengthened Canal in which to dissipate part of its force, while all influence of the river is withheld, the extreme tide can never exceed what it is at Tarda at present, or $+1$ in the dry months, except the dimensions of the Canal are much enlarged; its highest level in the rains depending upon the method of draining the town, of leading off the waters of the country into this outlet, as also upon whether any additional quantity of water is to be thrown in for filling the lake, and where its discharge is to be allowed.

The floors of the present Circular Road Drains at the respective places—

Head of Dhurumtullah,	at	$+2$.	1
„ „ Bowbazar,		$+5$.	1
„ „ Mutchoobazar,		$+2$.	4
„ „ Manicktullah Road,		$+3$.	3
Marhatta Ditch „ „ Sambazár Road,	Standing	$+2$.	10

will allow of the drainage remaining, without alteration of these floors, as long as the water in the Canal does not reach above + 3 during the season of rain. It is therefore clear, that the Lake withdrawn or embanked, cannot remove any facility of draining the town when the Circular Canal brings the Sundurbund tide in circuit so immediate to its drain outlets. It remains now to provide against any possibility of their remaining above this level + 3 during the rains.

The Lake remaining as it is, and no water being admitted from the river, the highest level in the Canal, except from the small influence of drain water from the town, will not exceed* + 2, and scarce reach that mark; and this influence I consider will never, even in flowing tides, raise the Chitpore end more than $1\frac{1}{2}$ foot under any circumstances.

It must now be considered that the drains, with the exception of the Dhurumtollah,† under the new circumstances of being so much nearer their outlet, will have great advantage; and as the lowest spot in Calcutta is much above‡ the highest of these drains, there will be rather an advantage than otherwise, in now and then allowing the tide to enter their mouths.

I may therefore safely assume that any scheme may be adopted which will not raise the waters above + 3 during the rains; and that under the contemplated circumstances an additional level of a foot may thus be allowed to the surface of the Lake, for the purpose of raising its bed with sediment, without danger to the drainage.

The Salt-water Lake adjoining Calcutta covers a surface of $18\frac{1}{2}$ square miles of land. From its lowness in level it is at present the receptacle, during the rains, of a considerable surface of country water; besides the more immediate drainage of the City of Calcutta. The principal influx of water is from the north and west; and in the rains, when this is at a maximum, there is an evident general slope of the surface of the Lake proportionate to this expenditure, which has been detected by the several series of levels which have been carried on at different periods.

The surface of this Lake, as may be seen in the Survey lately prepared, is naturally divided into three compartments. Two north of the present navigable§ channel and Lake outlet; and third, south of that channel. Of the two first, the western, containing $5\frac{1}{2}$ square miles, at present receives the greatest influx of extraneous water from the north towards Dum-Dum and west from Calcutta; but neither yields so great a depth of water, nor presents to the eye so great an expanse free from vegetation, as the neighbouring compartment of 7 square miles, which is separated from it by a natural rise in the bed, upon which vegetation has taken root, although the surface is almost at every tide under water.

The surface of the upper and of the first named compartment, towards the Sámbar bridge, is said by Major Schach to have an elevation of 2 feet above what I have ascertained to be the extreme level near Balyaghaut, which would give a slope of 7 inches per mile to the surface. Now as I know this elevation to be very partial, and owing to a certain admission of tide by the Sámbar ditches,|| I must reject such a slope, as at variance

* NOTE—A fall of 1 inch upon 5 square miles of the town will give 11,616,000 cub. feet water. The Canal discharge per hour, when sloping 6 inches per mile, will be 4,376,661 cub. feet. It would never be necessary to draw off an inch of water in less than three hours. The slope of the Canal being raised to 9 inches per mile, the expenditure will be 6,572,736 cub. feet per hour.

† This drain's exit has [so] no violent a slope at its mouth as to do harm at present; and an elevation of $1\frac{1}{2}$ of water would be advantageous to it.

‡ Lowest part of Calcutta at the mark + 8. 2.

|| Major S. took his level under the Sámbar bridge, making no allowance for the run of 1 mile thence to the Lake, or the resistance of the several bunds through which it passes into the Lake.

Western $5\frac{1}{2}$ Sqr. Miles.
Eastern 7 ditto ditto.
Southern 6 ditto ditto.

$18\frac{1}{2}$ Sqr. Miles.

¹ Sic in Original.
J. M.

with every other observation I possess relative to its slope, and particularly the velocity of its water, which certainly never attains to any thing, near what would obtain with such fall,* and I believe I shall be within the mark in assigning a slope of 3 inches per mile extreme, to the surface of this compartment during the rains generally, from the Sámházar enclosures to the Balyaghaut Chokies. The expenditure in this case becomes 11,612,080 cub. feet per hour, with a rate of $739\frac{1}{2}$ † feet per hour. This is even much beyond what I can believe to be true. The discharge of water from all the compartments of the Lake takes place rather by spilling over the banks of the outlet channel, (which have been raised to a level sufficient to be laid bare in the low tide of the dry season by the silt left on them by the continued flux and reflux of tide,) rather than through any more defined side outlet; and it therefore becomes difficult to ascertain the exact quantity of general expenditure‡ from the Lake in any state, except by an estimate from the dimensions and rate of this outlet, which is subject to a reflux in all cases.

That the Lakes if left to themselves would in the course of time fill up of their own accord, I have little doubt; and that such process is now in activity, is confirmed by the rapid increase of vegetation upon its surface within my own knowledge. I cannot, however, learn that much ground has been gained to cultivation during the last forty years; and although the amount of yearly filling up must at the present time be much greater than it was forty years since, another period of this length will probably, unless other means are provided to increase the yearly sediment, witness a very sorry progress towards their final recovery. Unfortunately during the present state of things the influx of Jheel water, although some of it is originally derived from the coloured water of the river Hoogly, brings little or no sediment; and as the water is quite clear before it reaches the channel of outlet, its discharge checks at this time any silt from the daily tide, and also washes away much that may have formed during the dry months.

The two principles, therefore, upon which I would rely for a more effectual recovery of the Lake, and of this compartment in the first instance, are, to prevent the influx of any water that does not proceed directly from the Hoogly or from a source whence sediment is certain, as from the drain outlets; and to encourage the growth of vegetation along the banks of the channel; until, by this means, in the course of a very short time, it will be easy to form a slight embankment at small cost, and over which the water may occasionally spill.

The quantity of river water to be admitted (and consequently the dimensions of the feeder Canal,) must then be regulated by the height of the water in the Lake, which may always be lowered by a slight check to the feeder, by which means the discharge will gain upon the supply. It is my intention to propose that the water of this compartment of the Lake be kept at an average additional elevation of less than 1 foot, and§ which would injure no property in the vicinity; or what would perhaps be still more perfect, that the supply be let in during the neaps, and so restrained in the springs, that the Lake near Balyaghaut shall remain at a constant level of 6 to 9 inches above its present extreme height. I will now consider whether a feeder of 100 or 200, [Sq.] hs.|| feet of section, and excavated in a way that would secure [it] them¶ from accident or from endangering the vicinity, would ensure a sufficient supply for the purpose, and what quantity of sediment might be looked for during the year.

* Section being 15,840 square feet, or 5,280 $\times 1\frac{1}{2} \times 2 = 15,840$.

$\sqrt[3]{=2}$ } Rate becomes 1213 feet per hour.
 $\frac{1}{6} = \frac{1}{9017}$ } or about $\frac{1}{4}$ th of a mile.

† About $\frac{1}{7}$ of a mile.

‡ Section at Baminghatta $120 \times 24 \times \frac{2}{3} = 1920$, Sq. ft. $1920 \times 5280 \times 2$, Miles per hour = 20,375,200, Cubic feet.

So that when the Lake is full the daily discharge cannot be less than 50,000,000, cubic feet.

§ || ¶ Sic in Original.
J. M.

The surface of this division of $5\frac{1}{2}$ square miles at an average depth of 2 feet, will give its contents of water 306,662,400, cubic feet. The contents of the adjoining division must be about double this quantity. Now a feeder Canal of 100 feet section, trapezoidal, having the slope of 1 foot per mile, will run at a velocity of $1\frac{2}{10}$ mile per hour, and supply 634,600 cubic feet only in that time. Increase the fall of the surface of this feeder to 2 feet per mile, and with the additional section gained from its trapezoidal shape, the rate becomes $2\frac{4}{10}$ mile per hour, and supply 2,194,614 cubic feet per hour. I should not think it advisable to exceed this velocity. For the months July, August, September, I may safely reckon, from the known state of the tide (and with allowances for closing the feeder when the river is too high, &c.) upon a medium supply of 900,000 cubic feet for twelve hours of each day—This quantity supplied ($900,000 \times 12 = 10,800,000$ cubic feet per day) would furnish a quantity equal to the present contents of this compartment in 30 days, exclusive of water brought from the drains, and therefore I might reckon it possible to fill this compartment of the lake, in the course of the rainy season, with four times its present contents of turbid water, direct from the Hoogly, by means of a single feeder of the dimensions named.

The proportion of sediment in the water of the Hoogly is at present unknown; it is therefore impossible to say what would be the quantity produced from a depth of 8 feet water. Several inches may be expected; only 2 feet average is required, but if this is not thought sufficient, it is always possible to increase the supply [by] or* enlarging the feeder, or furnishing a second: for it is quite evident that as the hourly supply of 2,000,000 cubic feet is so small, compared with what I have estimated as the expenditure along this compartment of the Lake, 11,612,080 cubic feet per hour, and a daily supply of 10,800,000 cubic feet, so small, compared with the daily discharge by the Bahmunghatta outlet, that the rise of the surface in consequence of so trifling a supply in addition, will not be 6 inches.

It will be said that the method I have now proposed, embraces only one-third of the whole Lake; but it must be remembered that it is the one of most importance to the Town; and likely to yield the greatest return. The same feeders, when they have completed this portion, may be turned into the second compartment, and the self-same principle may be applied to the southern division, if thought necessary, by a feeder direct from the high parts of Tolly's nullah about Kaleeghát.

The river Hoogly, it must be remembered, is the only source from which turbid water can be drawn, and this only during the four rainy months, 15th June to 15th October. The quantity of sediment in the Hoogly water will bear no proportion with that in the Ganges—and the tide waters of the Soondurbuns are notoriously clear during the rains, as also during the dry season, except in the spring tides, when they have inundated the land.

I have already mentioned that during the rains there is a general slope of the surface of the lake from the north towards the present outlet. To make this outlet the feeder it will be necessary to invert the present slope or raise the level near Balyaghaut above what it is at present near Sámházar, which must unavoidably interfere with the present drains. Besides that, by this means, as the present channel must be at once its supply and place of discharge, the supply, according to every sound principle, cannot be so constant and unremitted as if the supply were separate and at the upper end; and no hope can be formed that the bed will be raised rapidly by any means but a constant introduction during the rains of river water.

* Sic in Original.
J. M.

I have purposely connected the present scheme with the system of Canals now carrying on ; but upon mature consideration, I can see no good reason why any alteration in those Canals should be necessary for this additional object. The discharge Canal must necessarily be the best adapted for navigable purposes, from its depth ; and the constant tendency rather to increase its dimension than to fill it up ; and also from its lower level, most fit to receive all drain water.

If it is said that no real efficacious method can be adopted until the whole Lake is embanked, I need only advert to the very trifling additional rise of the surface of the Lake waters necessary in the present scheme ; and to mention that the adoption of such plan will, in the course of a very short time, give the means of embanking at a very trifling expense, where now such measure would be attended with very great charge and difficulty.

If the Circular Canal is made the feeder of turbid water to raise the bed of the Lake, it must unavoidably be subject to all the disadvantages I have pointed out in a former paper upon that Canal ; besides that, other means must be provided to carry off the drainage of the Town. This last point alone, in expense, would deter the Government, I apprehend, from such measure—for as the low level, fit for receiving the drain water, will be in this case either the Lake itself, or the series of nullahs eastward of the Lake, tunnels under the Canal must be excavated or a second Canal of sufficient dimensions must follow the line of the Circular Canal, and be continued perhaps to the very eastern boundary of the Lake.

By the present scheme, during the dry months, when the feeders no longer serve, the tide will be allowed as before to spread upon the Lake—for I would by no means offer any check to the spreading. In this also will the action of silting up be accelerated by the Circular Canal, into which a higher and dirtier—from its rapid passage through the Canal—tide will flow from the river, and not be allowed to return.

I therefore enclose a schedule of the method I would adopt for raising the bed of the Lake, and feel some degree of confidence that the principle of this scheme, or some modification in its detail will in the end be acknowledged to offer advantages and economy beyond every other design that could be proposed for the purpose.

No. I. (G 1.)

Scheme for raising the bed of the Lake to a level fit for purposes of cultivation, with statement of expense.

First. A closed drain must be excavated from the Sámházar bridge to Mohis-ghaut, 3 miles, to convey the present supply of Dum Dum Jheel water into the Eastern division of the Lake—Section average 90 square feet, costing about 1,200 Rupees per running mile.	3,600
Carried over,	3,600

	Brought over,	3,600
Second.	One feeder Canal to be excavated from Chitpore to the Western Lake. The floor at its river mouth, excavated to + 2 which will require 16 feet of digging. The floor at the lake end at Θ , or perhaps, 1.—25 feet broad at bottom, and trapezoidal, so that 6 feet of water gives section 200 square feet—average section of such an excavation being 530 square feet, will cost 7,680 Rs. per mile for a length of 3 miles.	23,040
Third.	Three bridges will be necessary over this Canal for the several roads. To each bridge I would provide some contrivance for closing the Canal, estimating each at 15,000.	45,000
Fourth.	Sundry expenses for preserving a channel as fast as the Lake may fill at the place of discharge from the feeder Canal; as also in embanking the side towards the discharge Canal, when sufficiently raised, also the western side, and watching the place of discharge.	15,000
	Supervision and contingencies.	4,332
Fifth.	Add the compensation for the acknowledged rights of fishery and incomes, now enjoyed upon the faith of the rights conferred by the perpetual settlement—estimate at One Lac of Rupees for the whole Lake for the Western compartment.	30,000
	Total expense and outlay.	1,20,972

N. B. The above does not include any charge for purchase of ground for the feeder Canal, and provides only a single feeder. It will be possible I believe to find ground from that purchased for the Circular Canal, without any material sacrifice in the resale of ground, from which a certain return is calculated upon to that work.

As per contra to the above;—

The contents of the Western compartment of the Lake are 10,630 }
 begas of land, the value of which, nett, when fit for cultivation, may } ... 3,18,900.
 be taken at the least 30 Rs. per bega yielding, }

It would be easy to shew that the recovery of the second compartment, in surface upwards of 12,000 begas, would be still more profitable in return, as it would be free from the great expense of excavation near Chitpore and bridging the Canal. With an additional outlay of 50,000, this second compartment would yield a return of 3 Lacs; but as this part of the undertaking is remote, I waive the introduction of it in the present scheme.

No. I. (G. 2.)

[LAND LEVELS.]	Feet.	TIDE LEVELS.]
High part of Strand,	20.	
	19.	
	18.	
	17.	
Government House road.	16.	
Châmpal Ghaut Stone.	15.	
	14.	
	13.	—Highest known rise of the Hoogly—August, September, October.
	12.	
	11.	
	10.	—Ordinary flood during the rains.
Lowest part of Calcutta	9.	
	8.	—Highest spring flood in April, May.
	7.	
	6.	
Calcutta drain floors along the Circular road. {	5.	—Lowest neap flood in September.
	4.	
	3.	
General level of rice cultivation in {	2.	—Highest Lake tide at Balyaghaut—August, September,—also highest ebb of Hoogly in August.
parallel of Calcutta.	1.	Lowest neap flood of Hoogly—March.
	0.	
Base.	0.	Ordinary flood tide, Balyaghaut—December to April.
	1.	
Supposed average bed of lake.	2.	
	3.	—Lowest neap tide ebb in Entallee Canal and Lake.
Lowest bed of lake.	4.	
	5.	—Neap ebb tide of Hoogly—March, April.
	6.	
	7.	—Lowest spring ebb of Hoogly—March, April.
	8.	

No. I. (H)

No. 8.

Captain Prinsep's Memoranda in reply to his Lordship's Questions of the 29th and 30th December, 1829.

Territorial Department. Revenue. Consultation,
16th Feb., 1830, No. 11

The daily variation of the tide at Bahmunghatta is from 6 to 9 feet. The neap ebb-tides are generally lower than the spring ebbs, on account of the influence of the Lake. The neap-tide ebbs of February and March, will, I apprehend, stand at a level equal to nearly —6 on my gauge table; while the spring-tide ebbs will be about the level of —5. The tides at the place Goaladunga, will be, within a few inches, the same in every respect as those at Bahmunghatta.

Tides at Bahmunghatta.

Survey & sounding in the Lake.

The plan of the Lake, of which two copies, on different scales, are in possession of his Lordship, was prepared upon a very accurate and minute survey, carried on by an European under my own immediate superintendence, and may be relied on for accuracy.

The soundings were also made by the same person, and have been generally verified by myself. The numbers, written as soundings on the plan, are intended rather to give the relative level of the bed of the Lake, than to denote any precise state of the tide.

Line between Tangra and Goaladunga.

The general nature of the soil on the borders of the Lake, is rather loose and crumbling, from being rotten and full of shells, but may still be considered favorable for canal cutting, with proper attention to the side slopes.

The cost of a canal of 80 or 90 feet breadth at top, and an average depth of 10 feet, will amount probably to something less than 10,000 Sa. Rs. per running mile, inclusive of every contingency, if cut on the skirts of the Lake, where the ground is dry, but still below high-water mark.

Creek below Goaladunga.

The Bayer Creek from Goaladunga to its confluence with the main Lake outlet, has, I suppose, an average breadth of 60 or 70 feet; and a sufficiency of water, at the lowest ebb, remains at Goaladunga for the common boats of the Lake trade, drawing less than 7 feet water, but not so for the larger boats of the trade. The large wood-boats, drawing 9 and 10 feet water when laden, could not conveniently navigate this Creek.

No. I. (1)

No. 9.

To HOLT MACKENZIE ESQ.

Secretary to Government, Territorial Department, Fort William.

Territorial Department, Revenue, Consultation,

16th February, 1830, No. 12.

SIR,

The rents paid to the Zumeendars for the lands bordering on the Lake are nowhere less, so far as I can learn, than two rupees per begah; and in most of the places it will average from two rupees twelve annas, to three rupees.

2. Should the Lake be drained, as its area is upwards of 60,000 begahs, the produce in the shape of rent to the landholders would be about 120,000 rupees per annum, allowing for Waste Lands, &c. &c., but the Jhulkur and Pattee would be lost, so that the excess to their present profits would be about rupees 90,000 per annum. There would be no fear of the supply of fish for Calcutta failing, as the cultivation now being carried on in the Soonderbuns would afford shelter and places of abode for the fishermen, who at present are unable to go very far into the Waste.

I have the honor to be, Sir,

Your most obedient Servant,

(Signed) W. DAMPIER,

Commissioner.

CALCUTTA,

13th Jan., 1830.

No. II.

TO THE SECRETARY TO THE HONORABLE THE COURT OF DIRECTORS.

Territorial Department. Revenue. Consultation,
16th February, 1830, No. 13.

SIR,

I am directed by the Right Honorable the Governor General in Council, to transmit to you for the purpose of being submitted to the Honorable the Court of Directors, the accompanying copy of a Minute of the Governor General's, dated the 2nd instant, together with copies of the several documents therein referred to (as per accompanying list) and to request the particular attention of the Honorable Court to the subjects of the 20th, 21st, 22nd, and 23rd paragraphs of the Minute.

I have, &c.

HOLT MACKENZIE,

Secy. to the Government.

No. II. (A.)

*List of Documents referred to in the Minute of the Governor General,
dated the 2nd February, 1830.*

Territorial Department. Revenue. Consultation,
16th February, 1830, No. 14.

1. Major Schalch's printed Memoir, on a Plan for the formation of an easy and permanent communication by Water between the Upper and Eastern Provinces of India and Calcutta, during the dry season.

2. Survey of the Salt Lakes, or Marshes adjoining Calcutta, by Captain T. Prinsep, dated December, 1828.

3. Survey of the Sunderbuns, by Ditto.

4. Captain Prinsep's Answers to Questions put by the Governor General.

5. Printed Tables, exhibiting a daily Register of the Tides in the River Hooghly at Calcutta, from 1805 to 1828, by James Kyd, Esq.

6. Captain Prinsep's Memorandum and Diagram on Tolly's Nullah.

7. Captain Prinsep's Memorandum on the Salt Water Lakes.

8. Captain Prinsep's Memorandum in reply to the Governor General's Questions, and estimated cost of the new Circular Canal.

9. Letter of the Commissioner in the Sunderbuns, dated 30th January, 1830, relative to the extent of the Lake, and average rent per beegah for lands in its vicinity.

HOLT MACKENZIE,

Secretary to the Govt.

TERRITORIAL DEPARTMENT,
16th February, 1830.

NOTE—On the back of the above Document [marked No. II. (A)] is written, "Nos. 1, 2, 3, and 5, sent home in original."—J. M.

No. III.

EXTRACT FROM THE HONORABLE THE COURT OF DIRECTORS' LETTER,
DATED THE 10TH NOVEMBER, 1830.

(No. 1.)

Para. 1. We shall now reply to your Secretary's letter dated 16th February, 1830, in which our particular attention is solicited to a Minute of the Governor General, dated 2nd February, 1830.

2. In this Minute the Governor General proposes, that the line of the canal, now executing according to the plans of the late Major Schalch, shall pass to the Westward of the Salt Water Lake, instead of through the Lake, as originally designed, and that the Lake shall be drained and embanked. This would, in his Lordship's judgment, greatly improve both the salubrity of Calcutta, and the navigation from the Hooghly into the Sunderbunds. It would also gain a great quantity of valuable land—but the Lake has been disposed of in perpetuity, paying a rent of about Rs. 4000 per annum to Government.

3. The Minute and its accompanying documents detail the plan and estimate, the cost and returns.

4. The Governor General proposes—

(1.) That the plan should be submitted to Messrs. Telford, and John & George Rennie, for their opinion.

(2.) That if we should be unwilling to undertake the measure, we will permit individuals, including our servants, to embark their money in the work; and,

(3.) That the Company should bear one half of the expense in return for the improved Navigation and the increased Tolls.

The Governor General further states his conviction;

(4.) That “incalculable benefit might be derived from the deputation to India, for “two or three years, of an eminent Civil Engineer, well acquainted with all the improvements of latter years, who should visit our Territories, and report upon the possibility of “calling forth the hidden and dormant resources of our immense Empire, by the skilful application of improved science and modern invention.”

5. On these proposals we observe—

(1.) The practicability of the plan depends on the correctness of the Data in the documents, especially with reference to the Soil and the Levels. The utmost, an Engineer not on the spot, can say, is, that if the Data be correct, the plan is practicable. No opinion to this effect can be of any value, or involve any responsibility, except as the result of personal observation on the spot.

No. III.—(*Continued.*)

FURTHER EXTRACT from the Honorable the Court of Directors' Letter dated the 10th November 1830, subsequently obtained by the Municipal Committee.

4. The Corps of Bengal Engineers contains Officers who acquired very high reputation at Addiscombe: some of these Officers have been in England on furlough after having acquired much knowledge of local circumstances in India, and have whilst here, paid their particular attention to all recent improvements in machinery and in the application of the useful arts. Captain Hutchinson, for instance when in Europe, in addition to his most attentive inquiry into the improvements of Steam machinery, is understood to have made himself acquainted with the different modes of embankment practised here and in some other parts of Europe, particularly at Vienna, where the embankments are very extensive.

6. There are now here two distinguished Officers of this corps, Captain Irvine and Captain J. Thomson,* both of whom it is understood are warmly interested in the progress of mechanical science, and of whose services you may avail yourselves on their return to India. It therefore seems to us unnecessary to take any step in furtherance of this proposal.

* One of the Officers to whom the Military Board referred the Papers of Lord W. Bentinck.



(2.) The Plan is a gratifying proof of our Governor General's desire to improve the commerce of India, and increase the salubrity of Calcutta and its vicinity; and, so far as we can judge of it, promises much public benefit. We leave it to your discretion to undertake it wholly yourselves, or to permit individuals, including our servants, to embark their money in the work. If you undertake it on account of the Company, you will do well to open a negotiation beforehand for purchasing the Salt-water Lake. You will be careful before undertaking the measure to obtain the most absolute accuracy in respect of the Soil and the Levels.

(3.) If the work be undertaken by private Individuals, it must be undertaken wholly by them on the same conditions on which Major Tolly executed the Nullah which bears his name, that of receiving the entire tolls for a limited number of years.

(True Extract)

FREDERICK JAMES HALLIDAY,

Secy. to the Government of Bengal.

REVENUE DEPARTMENT,
5th September, 1839.

No. IV.

To CAPTAIN YOUNG,

Secretary Military Board.

MY DEAR SIR,

The Governor General desired me to send you these papers,* and to request that the board will take the subject of them into consideration; and his Lordship suggests that Captain Thomson, now in charge of the Canals, and other persons, capable of affording information on the subject, should be consulted.

[* To wit those marked I. to III. inclusive.—J. M.]

A day will be hereafter fixed for a Meeting to discuss the subject before the Governor General.

Yours sincerely,

(Signed) C. MACSWEEN,

2d September, 1833.

[Private Secretary to Governor General.]

A true copy.

(Signed) H. DEBUDE,

Offy. Secy. Military Board.

No. V.

[MINUTE BY COLONEL SIR THOMAS ANBURY, C. B.

SUBMITTED BY HIM TO LORD WILLIAM C. BENTINCK, GOVERNOR
GENERAL IN, IT IS BELIEVED, DECEMBER, 1833.]Received from the Chief Engineer's Office—
2nd March, 1840.*On the Salt-water Lakes, with a Plan for filling them up.*

I have read all the Papers attentively regarding the Salt-water Lakes, as well as the late Capt. Prinsep's replies to the Queries by the Right Honorable the Governor General; and I am thereby confirmed in the opinion that I held many years back, and long before the Entally Canal was formed, of the practicability of reclaiming the upper parts, if not the whole of the Salt-water Lakes, by means of partially bunding and warping, or both combined; and I think that Capt. Prinsep's Survey of the Suburbs of Calcutta, including the Circular Canal, Salt-water Lakes, and Eastern channel, clearly shew the means of filling up or reclaiming the Lakes, or a considerable portion of them, in a very practicable point of view by the method alluded to; and which will be hereafter explained; and one of no very difficult or doubtful accomplishment.

Many parts, there seems to be no question, (and the lower portion especially) are never entirely dry or without some water: but, according to Capt. Prinsep's replies, and what he has laid down in his Maps, there are very considerable portions that are left dry at low water common tides; and still greater portions, no doubt, at low water neap tides in the dry season. These shoals I conceive may be made useful, by proper means, for obtaining and establishing substantial and permanent ground in aid of subsequent operations.

The vicinity of the Lakes would, I imagine, furnish ample supplies of materials for progressing the operations; and, from the present, and natural circumstances of the Lakes, they may be so successfully managed as considerably to contribute to their self-silting; and without very great labour or very expensive artificial means.

A favorable circumstance for operations, is, that the waters of the Lakes (I believe throughout) discharge into the great Eastern channel and principal drain, by small sinuous gutters or channels, which it seems have not any considerable velocity—but rather that the current through them, is tardy, and very languid; and that they rather spill over into the main channel; and this from the slowness of the ebb in the great channel, and the inconsiderable depth of water at the very highest levels of the Lakes: from this, I am induced to think, that they may, without much difficulty, be rendered subservient to the object in view; for, as the upper or northern extremities of the Lakes are filled up, the waters would have less expanse to flow over; and their reflux would consequently become much accelerated and more rapid.

If any dependence is to be placed on Capt. Prinsep's Scale of Levels, which is hardly to be doubted, there does not appear to be any reason to apprehend material obstacles or bar to the practicability of reclaiming the whole of the Lakes, by Draining. Bunding, and

subsequent Warping: the Draining will be naturally gradual, but may be regulated as required by bunding small tracts, and reclaiming ground by degrees; as will be explained hereafter.

It is within my recollection, that what is now the Entally Canal, was, originally, a series of large pools from the Salt-water Lake, to that part of Entally which connects with the Circular Road, (then only a bye and little frequented path of the filthiest description) and known as the Calcutta boundary; and called the Maharatta Ditch. Many years have passed since I was on the Lakes; but their nature and appearance, at the time, is strong in my recollection; and what I then thought might be done to reclaim the land to a state of cultivation. That the Lakes must have (however imperceptibly, or from what cause) shallowed, or filled up in a very considerable degree, their present state, as laid down in Capt. Prinsep's Maps, leaves little reason to doubt; notwithstanding that the water principally flowing into the Lakes is not of a kind likely to hold much alluvion, or earthy matter; yet it may have acquired much of its shoally appearance from the warping from land floods, running, by small channels, into the Lakes, in various directions; and upon this supposition I am induced to think facilities to silting or warping, by like means, are not entirely out of reach; and may be even easily obtained by bringing the loaded or coloured water from the Hooghly into the Lake, by making the Circular Canal the Channel or principal feeder; which, assisted by other means, I am sanguine in the belief, will render the undertaking neither difficult or doubtful.

I am not inclined to consider Capt. Prinsep's observations on Tolly's Nullah as bearing at all on the practicability of my scheme; since, I cannot think, that Tolly's Canal can have any thing to do with the matter of filling up, or draining the Lakes; an operation that must be effected by the great Eastern channel with which Tolly's Nullah forms a junction considerably below the Lakes near Tardah; and in no way affecting them as far as the tides flowing through Tolly's Nullah are concerned; and therefore, in my judgment, cannot, in the smallest way, govern the drainage of the Lakes.

What Capt. Prinsep has advanced, regarding the channel of Tolly's Canal, cannot be of any consequence with reference to the waters of the Lakes;—and the silting near to Russapuglah still less;—which in my humble opinion has nothing whatever to do with the subject: and it may be explained by, or attributed to, the influx from the Sunderbunds meeting the slack current from the Hooghly at the point mentioned, and creating a dead water favorable to a silt, with which the Nullah water, out of the Hooghly, is always abundantly charged;—especially during the freshes—and this I conceive to be the most probable cause of the shoal alluded to by Capt. Prinsep.

But, to return to the Lakes, I am equally of opinion, that the Entally Canal cannot have much, if anything, to do with the object of reclaiming the Lakes; and it is equally immaterial what may be its sediment, with reference to the operations that must be pursued on them, since that part of the Canal must at all times be a back water to where the Lake waters will fall into the Eastern channel; and any increased depth to the Entally Canal would in no way affect the drainage of the Lakes.

What Capt. Prinsep says regarding the sediment of the Lakes, is rather, I am of opinion, favorable to the undertaking than otherwise; he says "it is partial, and chiefly confined to the immediate neighborhood of the channel through it," and this is shewn in his Map; and I think in a great measure goes to prove, that the waters of the Lake do give a silt, however trifling; which by proper means may be increased and secured.

Since the Entally Canal (as it is said) has no great current, whatever matter it deposits, will not be carried into the great Eastern channel, so as to interfere with the drainage from the Lakes, into that channel, at any time, but especially during the neap ebb tides: but if it did, there are means of clearing the channel, and creating a stronger current—besides materially assisting the works on the upper Lake, near its junction with the main Canal, and accelerating the navigation at the same time.

I am inclined to believe that the surrounding land of the Lakes is, to a certain distance towards its shores, principally, if not all, alluvion; and that the waters of the Lakes have been of a greater extent than they are at present; and I think it more than reasonable to suppose so, from the proximity of the cultivation to the margin of the Lakes, and the shallow depth of water they at present exhibit near to the cultivated ground; this may also help to support the supposition that a natural silting has taken place however slow or partial; and that if proper measures are adopted, that silting may be improved with feasibility, and thereby, and by means of warping and bunding, progressively reclaiming the whole of the Lakes; and for effecting all this, the surrounding country affords abundant means.

Much of the bunds, or margin of the Lakes, whether naturally or artificially (if Mr. Prinsep's Survey and Map is correct) have been recovered from the swamps, and it should appear the latter, (I will not presume to say by stealth;) but what would induce the belief is, that it is quite to the water's edge under cultivation, as shewn in the Map of 1830; and this has probably been accomplished by small means, and unobservable degrees; which induces a reasonable conclusion, that when bold and ample means are adopted, the progress, in so desirable a work, will be, in a proportionate ratio to the means used, more increased and efficient:—thus much on the present state of the Lakes, as connected with the Eastern channel.

Previous to entering into the explanation of the means I conceive may be successfully employed for the accomplishment of the work, I beg to premise, that no estimate or any calculations have been made regarding the work; or of the cost and contingencies that may be found requisite; and must be incurred in the prosecution of the work or undertaking; nor has any attempt been ventured at contrasting the great possible benefits to be derived by Government, and the public generally, on the successful completion, with the outlay that must be incurred.

The Levels of the Hooghly river and the Salt-water Lakes, comparatively, is hereafter considered,—and a Diagram made (see Plates 1, 2, according to Mr. Prinsep's Scale of Levels) for shewing the practicability of bringing the river water, for silting, into the Lakes: and I have little doubt of the success of this, as an auxiliary, in reclaiming the Lakes, after the channels by which they are naturally crossed and intersected, and by which the water now passes out of them, are stopped and bunded where it appears that they are most shallow or least covered by the medium tides; and by a bund along the line of the Eastern channel, by which the waters of the Lakes ebb out as the tides fall:—this bund would also afford a towing path, at present much wanted, along the Eastern channel, with proper openings, or self-acting sluices.

If the Surveys, or what has been laid down as the features of the Lakes, are correct,—which however are without any Levels of its natural bed, which I should presume is nearly equable—the first means I would employ, for a complete drainage, would be by bunds; progressively securing what has been drained, or more properly described, what appears at

present shallow or a partial silting; and the latter I should judge to be the case from Capt. Prinsep's Maps of 1829 and 1830; which shew in the former an entire sheet of water, and in the latter a silting or increased accumulation of soil nearly all round.

It is not to be expected that this drainage can be effected immediately; but it may be done progressively, according to the number of hands and extent of labour employed, in a moderate period. First, then, I would propose the desiccation of the Upper Western or Smallest Lake, by draining into the Eastern channel,* for which, it appears by Capt. Prinsep's Map of 1830, there is abundant facility by means of the contracted space between A, B; which is probably very shallow, and may be easily and speedily bunded (if the depth of water in the upper Lake is accurately given, namely, "never more than 2 feet," the distance being only 3100 feet—see Plan No. 1.): this bund I would propose to be composed of a double hedge of wattles or hurdles, 10 feet apart, and filled in between by the soil of the Lake thrown in from outside the southern hedge of wattles; which may be done by hand at low water; or a dredge, when the water is at its highest even; or materials brought from the terra firma along the spits of land; or silt that would be joined by this bund; and which would allow of the work being prosecuted even while the Lake is flooded: these spits might be at the same time secured by a similar bund—if deemed requisite—and would be consolidated by the passing and repassing of the labourers thereon; and might be carried on with considerable rapidity. The bund should be commenced at B, and crossed to A; but, if dry material can be obtained from the terra firma in the vicinity of Ballia Ghaut or the Entally Canal, I would work on the shoal or spit, from C to A—whereby it would be confirmed, and a strong bund formed—elevated above the highest flood of the Lakes—and would materially facilitate the construction of that from A to B:—and perhaps it would be the best method to work at the same time from D to B—and then join A B. While in operation the tide must be allowed to flow into the Lake (western) until the barrier is completely formed; and then securely closed:—the influx of the water would then be at E and F,—which might also be bunded at the points E, F, or G, when the draining has been completed; and at G might be constructed a small drain sluice, to let off any water, accumulating from rain or ooze, remaining after the tide waters have been let off in inequalities of the bed of the Lake.

The Southern portion may be drained, by the natural channels, into the East division of the Lake, as at U, which may be bunded in the same way, or quite along that bank from T to K, if requisite: a draining sluice might here also be required. Until warping could be commenced on, this operation, for the upper or Western portion of the Lake, may be effected from the waters of the Hooghly, by means of the Circular Canal, and by sluices or dams with vanes or self-acting flood-gates (at 1, 2, 3, 4): the latter would require little attendance, or less than the other modes of letting in the water, and would afford an ample supply of coloured water, giving abundant alluvion or silt, to bring the upper Lake to a level above the highest springs of the Lakes, which are below the level to which the water can be raised in the Circular Canal; and which might be raised, or increased, by means of a Lock at the junction of the Circular with the Entally Canal at H, to any height required; this might also be used as a scourer to the upper part of the Eastern channel.

I imagine that much silt, or alluvion, might be obtained from the water-courses

* It may be also drained into the Eastern Lake, into which lead several natural channels.

and drainage from the lands surrounding the upper Lake ; and from a channel to the northward, from rain-floods and land waters accumulated on the grounds to the North of the Dum-Dum bridge, and where, according to the Map, a considerable silting or filling up, appears already to have taken place. These waters, when they have yielded their deposit, may be drained off by the small channels E, F, and sluice at G.

I do not contemplate that any diagonal bunds will be found requisite to retain the silt in the upper Lake, or perhaps only in a few places, to preserve the level, or an equality of silting from the Canal or northern drainage.

For wattling this longest and principal bund—abundant material from the surrounding country would be procurable ; and likewise for the diagonal bunds in the adjoining Lake :—no great quantity I imagine would be consumed (principally gransticks and brushwood, made into fascines) ; or would it be long ere the whole of the shallows may be connected, and entirely secured from the influx of the water from the Sunderbunds.

The Upper or Western Lake being secured—the next operation would be to establish a bund on the northern bank of the Eastern channel—or passage through the lower Lakes, from “ Chingrahatta ” to the drains near the second Choke—to be constructed as described for the Western Lake :—this (the Eastern division) being drained by cross bunds through the channels above the second Choke ; and at T they might be bunded up, and the bund continued on to V—affording also a good towing path. This perhaps would be a more serious and laborious undertaking than the work afore detailed ; in as much as it must be executed in a greater depth of water, and probably may be exposed to a stronger influx from the Sunderbunds ; and the line to be bunded, on the bank of the channel, more extensive : but the small sinuous channels, or drains running diagonally through the Lake, as described in Capt. Prinsep’s Memoir, I am led to imagine would greatly facilitate the operation, as it appears, that the water of the Lakes pass off through these at ebb tides, leaving both Lakes almost dry, or at least so near it, as to leave them in a state very favourable for securing or certainly gaining upon the shallow parts ; and by degrees, if not immediately, putting them in a state to resist the influx from the Sunderbunds.

The Lakes, being intersected by small and sinuous drains, all leading to the main channel, by being progressively choked or bunded, would be made to deposit whatever alluvion they may hold in their flow into or out of the Lake—keeping open only one or two, to carry off the water while the operation of bunding is in progress—but as the channel is indolent, the more favourable to silting, or not possessing velocity beyond what is barely sufficient for the purposes of navigation, the operations would, I imagine, here be very slow and tedious (I mean in the Lower Lake) and probably not so satisfactory as is contemplated in the upper Lake ; yet, by Capt. Prinsep’s Memoir, the current, at Bhowni-Ghatta, is represented as wide and rapid at low water, with 15 to 20 feet of depth—this would favour a belief that the channel would be favourable to an equally rapid drainage from the Lakes ; but if so sluggish as represented, it may be considered whether a Lock at Ballia Ghatta or Chingrahatta might improve the velocity in the immediate vicinity of the lower Lakes, and by keeping the water within the boundary or course of the Eastern channel, by bunds on each bank, facilitate the drainage on both sides, and give greater force to the current for the purposes of navigation.

Silting of the lower Lakes (the Eastern division in particular) seems to be the most difficult, but, I imagine, not impracticable. If like the northern Lake, [it] must first be drained, and that in the same manner as the West division ; and then bunded :—and it *they*

seems, from the extent, that cross bunds will be required to arrest whatever alluvion or silting matter may be washed and conducted from the surrounding lands. In the absence of sufficient data, I am unable to say or to form any opinion as what besides can be done to effect the object in view.

The shortest distance in this Lake to be bunded is 5,000 feet, and the longest distance 8,000 feet, according to the Chart by Captain Prinsep of 1830, without any appearance, or promise of aid from shallows. However the Western portion, by draining through the Eastern, and by being agitated in the operation of bunding from C to D, including A, B, might furnish some silting; and the bunding from K to L would probably furnish a pretty accurate criterion of the possible success on the other lines M, N,—O, P,—K, Q,—R, S; and I think that the agitation caused in the northern bunding would shew what might be expected—the drainage of which would be through the different bunds, and discharged ultimately by the natural channel at S;—and for the lower parts, south of R, S, it would run through one or more channels at T, T, T—what quantity of silt, or whether any would be arrested by means of these bunds, I will not pretend to say, but I should expect, that some would be obtained.

The South portion of the Lake seems to be less difficult, and offers greater facilities than the other divisions—and by no means requiring great labour to reclaim.—In no part is there more than 2,400 feet breadth of water; it is likewise intersected by channels, through which it might be drained; the shoals are considerable and little bunding would be required:—possibly the inhabitants of the vicinity, of this part, might, through proper management, be induced to accomplish it for the sake of the land to be gained, or to exert themselves in affording assistance to such a desirable measure. Of the Eastern Lake, or as it is called in the Chart of 1829* Kalydar-Dhappa, there seems to be fewer obstacles than in either of the others; and, if the topography is correct, much land seems to have been already reclaimed by natural operations; and I am inclined to imagine that a much greater expanse of water has heretofore existed there, [than] that at present, as it is laid down on the maps.

[* Qy. 1830.—J. M.]

The work, I think, should commence on the Western Lake (No. 1) by throwing the bund from A to B, and also working from either side C, D, towards A, B, and draining by the channels E, F;—the bund being completed and secured, the drainage of the lower portion would be effected by the channel U, into the Eastern division;—and this portion being drained, the channels at U, V, must be dammed up, and all minor outlets into the Eastern channels, to secure the part drained from the influx of the tides from the Sunderbunds.

In a similar way must (No. 2) the Eastern division be managed;—but, there not being any record of the Levels or Soundings, at least none appear to have been made or within reach—what difficulties may arise from inequalities of the sole or bottom of the Lakes, it is not possible to say; but if the Data is correct, that in the Western, there is not more than 2 feet water, and in the Eastern 3 feet water at highest flood tides; and at lowest neap tides both are nearly dry:—I should not fear any great difficulties in accomplishing the work, in the simple manner proposed.

The Southern division as before stated, seems even more practicable,—following the same operations, draining by the small channels running through it (and intersecting it) into the Byah Nullah, and then bunding, as found requisite, to keep out the influx of water from the Sunderbunds. In conclusion, I would bund both sides of the Eastern Channel or Canal from Chingrahatta to an extent down the Canal, that would effectually secure the reclaimed ground from inundation, even at the highest tides, and at the same time form a very com-

modious towing path; which is at present very much wanted for boats coming up to the entrance of the Entally and Ballia Ghaut Canal, on an ebb-tide.

From a careful and attentive examination of the Levels on the Scale given by Captain Prinsep, and laying them down, on a Section from the Circular Canal to the Salt-water Lake, and from the Hooghly at Calcutta to the Circular Canal, it does not appear to me that there is any difficulty in bringing the coloured water of the Hooghly to the Western Lake, (No. 1) through the Circular Canal: it is very probable that objections will be started as to the effect these feeders may have on the navigation of the Canal; but I do not at all apprehend any that may not be guarded against or obviated, if found to exist; I would however submit the scheme to the original projector or director of the Canal, for his opinion.

I have given sketches of the sluices or flood-gates that may be employed in the work, but I would court investigation of their efficiency and the feasibility of my plan altogether.

I have not, as I said before, framed any Estimate of the cost or expenses to be incurred, or calculation on the quantity of silt that must be brought into the Lakes, or their sites after they have been drained;—this may perhaps be best done by the party or parties who may be employed upon or intrusted with the management of the operation, should measures be adopted for carrying the plan into effect.

Colonel, Chief Engineer.

No. V. *(continued.)*

APPENDIX.—It is very little more than two miles from the northern part of the Lake to the entrance of the Canal from the River Hooghly; and much about the same distance along the Dum-Dum road, on each side of which there are wide and deep drains running into the channel under the Dum-Dum bridge, which would afford very considerable washings, if connected with the Circular Canal at high tides in the freshes, into the upper parts of the site of the Western Lake—which, when they had deposited their alluvion, would be drained off, by the sluice or outlet at G, with the ebb tides, toward the Eastern channel—the same as the washings and land floods, led towards the upper Lakes, when they had given their deposits.

(Signed.)

T. ANBURY,
Colonel, Chief Engineer

Circular Canal

Highest Lake tide Balia Ghat Augst Sept^r

Ordinary Lake tide Balia Ghat Dec^r to April

Lowest Neap tide ch in Lake & Entry Canal

Bed of Circular Canal

1

Highest part of Strand Road

Canal Bridges

Chandpur Ghat Stone

Schallie Base line as provided (Meneer 21)

Zero or mean level of Lake

Lowest level of Lake

Bed of Circular Canal

Head

Circular Canal

Head

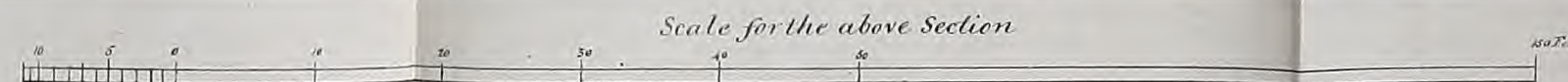
Head

SECTION OF LEVELS
to accompany the Chief Engineer's Memoir,
on the subject of Draining the
SALT WATER LAKE.

The Transverse proportions are correct, agreeably to Cap^{tn} Prinsep's Gauge See AB

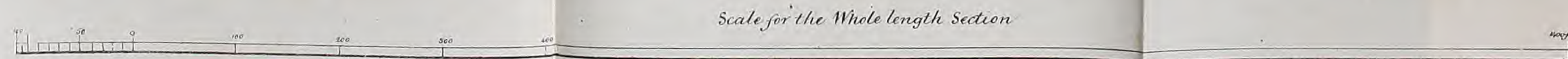
*The Longitudinal dimensions are considerably contracted and adapted
to the size of the Paper, but the relative Levels are preserved, and as
before observed quite correct*

Contracted Section on a large Scale.



Reduced Section of the Whole length.

From the Circular Canal near the Narcondanga Bridge, to the Salt Water Lake, 9700 Feet agreeably to Captain Prinsep's Map of the Suburbs of Calcutta 1850



100 Feet

Map of the Suburbs of Calcutta 1850

100 Feet

Cultivation

Cultivation

Cultivation

Highest part of Strand Road

Canal Bridges

Chandpal Ghat Stone

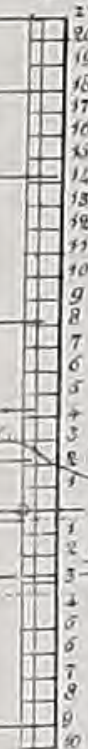
Salt Water Lake

Schatch's baseline in printed Memoir (p. 1)

Zero or mean level of Lake

Bed of Circular Canal

B



Highest Lake tide at Balu Ghat August September

Ordinary Flood tide Balu Ghat Dec to April

Lowest Neap tide ebb in Lake and Entally Canal

Lowest Bed of Lake

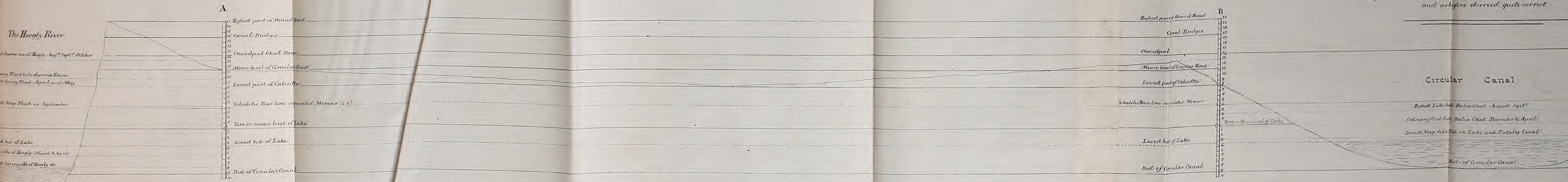
Salt Water Lake

Cultivation

SECTION OF LEVELS

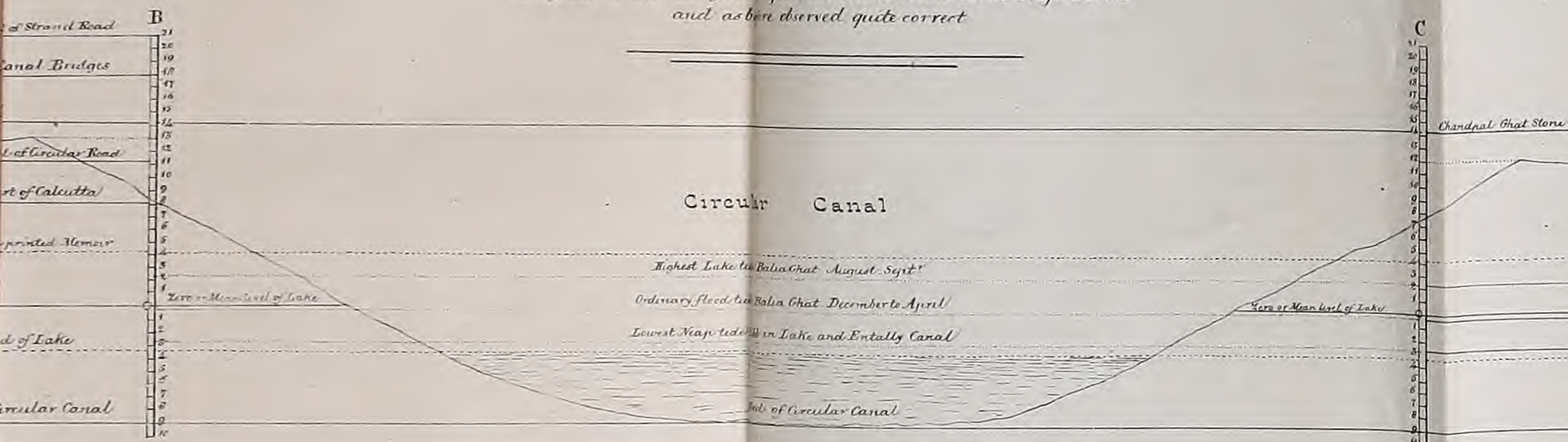
to accompany the Chief Engineer's Memoir
on the Subject of Draining the
SALT WATER LAKE.

The Transverse proportions are correct agreeably to Capt^l
see A B C and D
The Longitudinal dimensions are considerably contracted
adapted to the size of the paper but the relative levels are
and as before observed quite correct

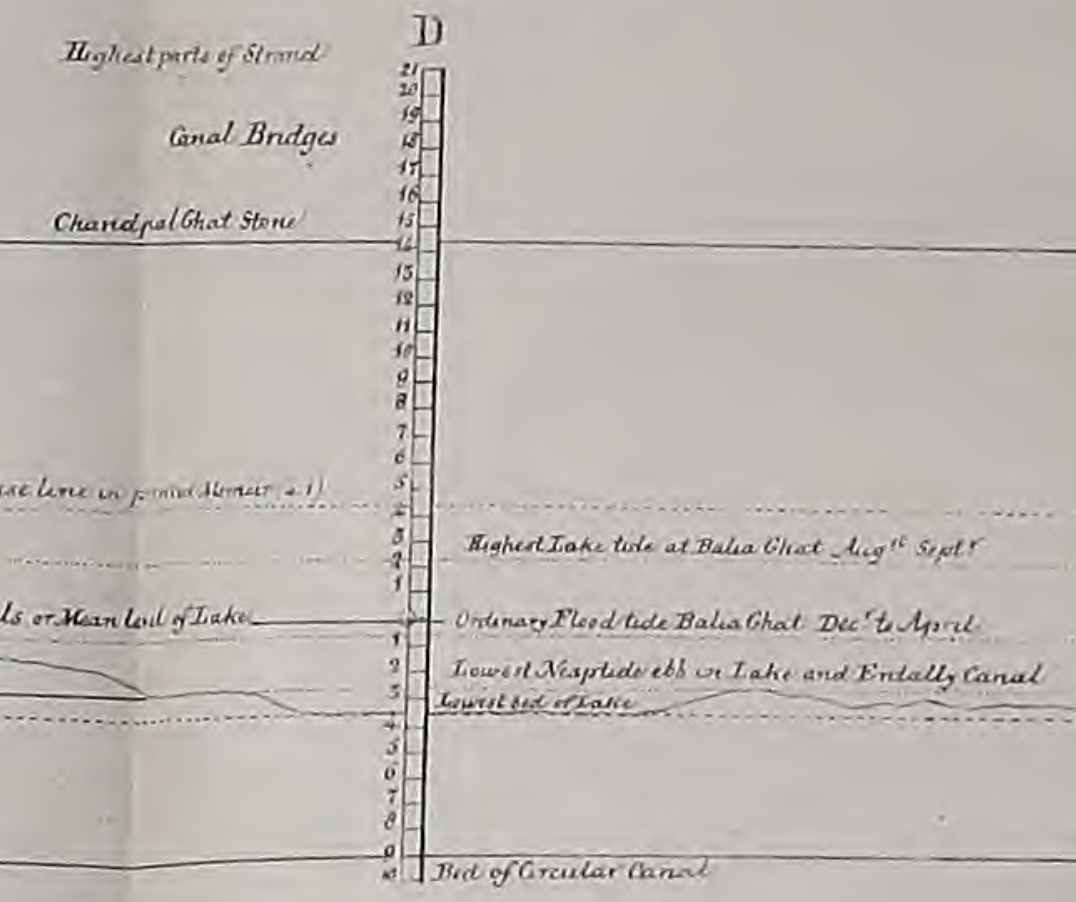


SECTION OF LEVELS
to accompany the Chief Engineer's Memoir,
on the Subject of Draining the
SALT WATER LAKE.

*The Transverse proportions are correct agreeably to Capt^l Prinsep's Gage
see ABC and D
The Longitudinal dimensions are considerably contracted and
adapted to the size of the paper but the relative levels are preserved
and as been observed quite correct*



Salt Water Lake

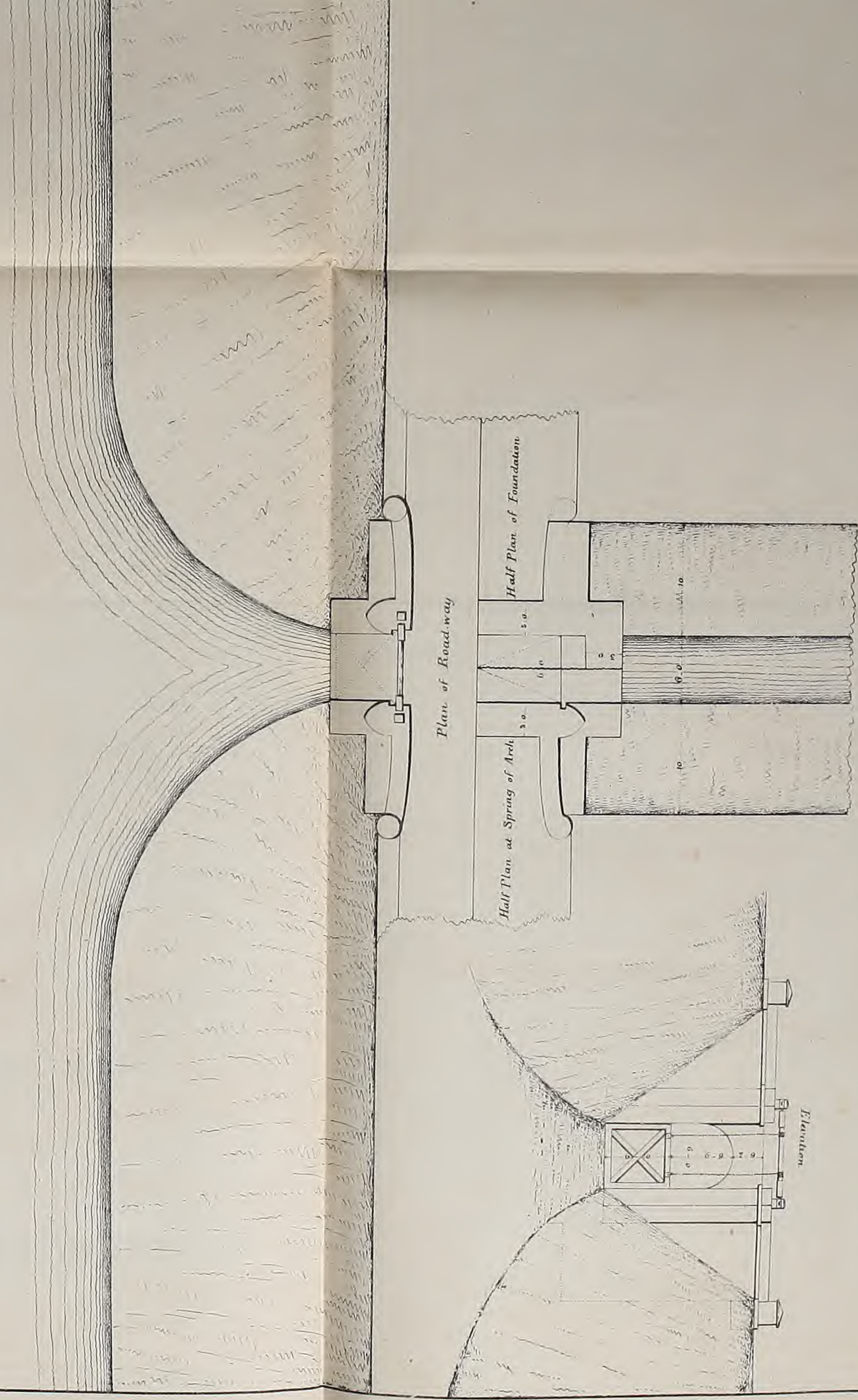


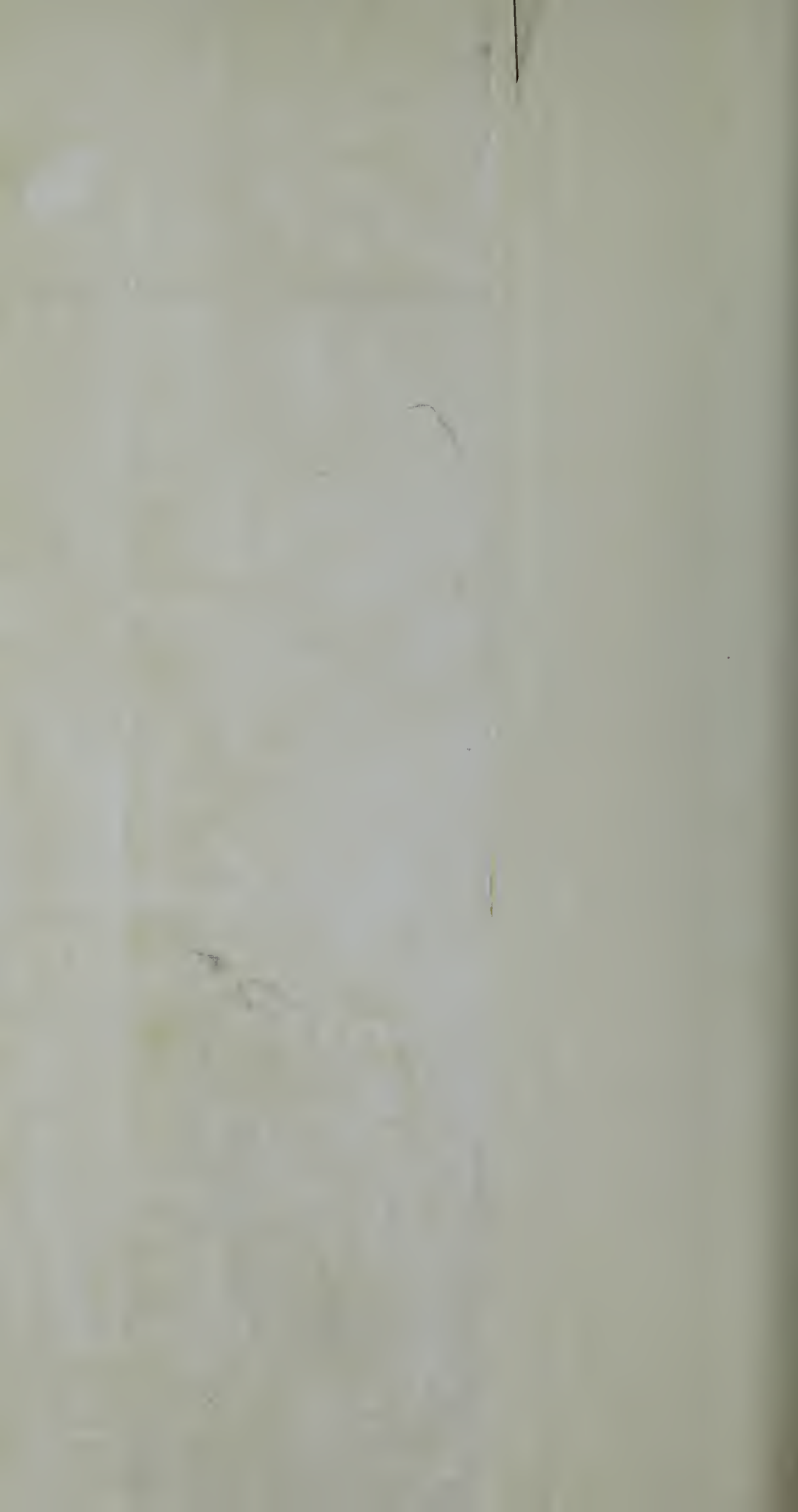


Plan of a Sluice for the New Cuts proposed to be made from the Circular Canal to the

Salt Water Lakes to let in the Water from the Hoogly River.

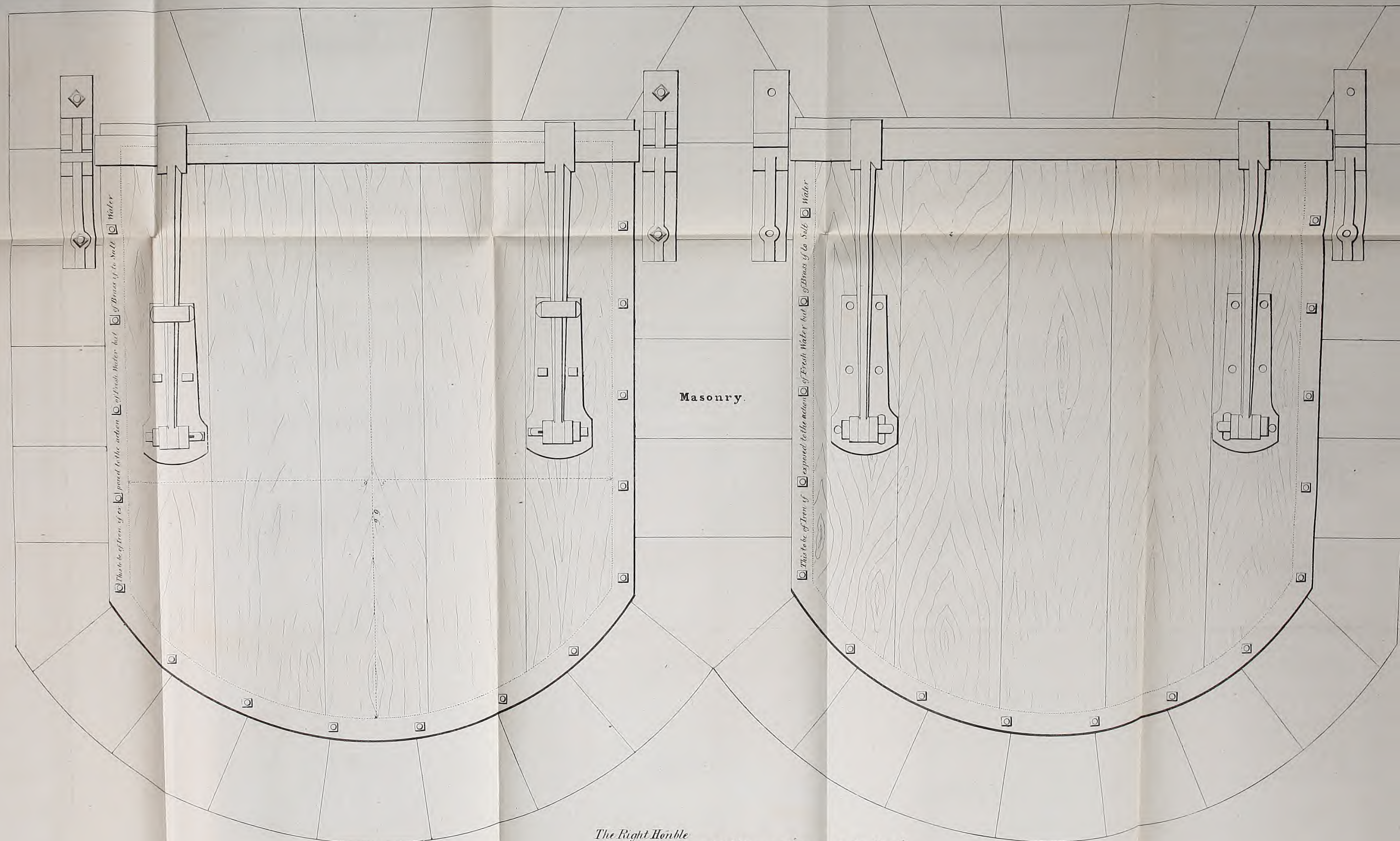
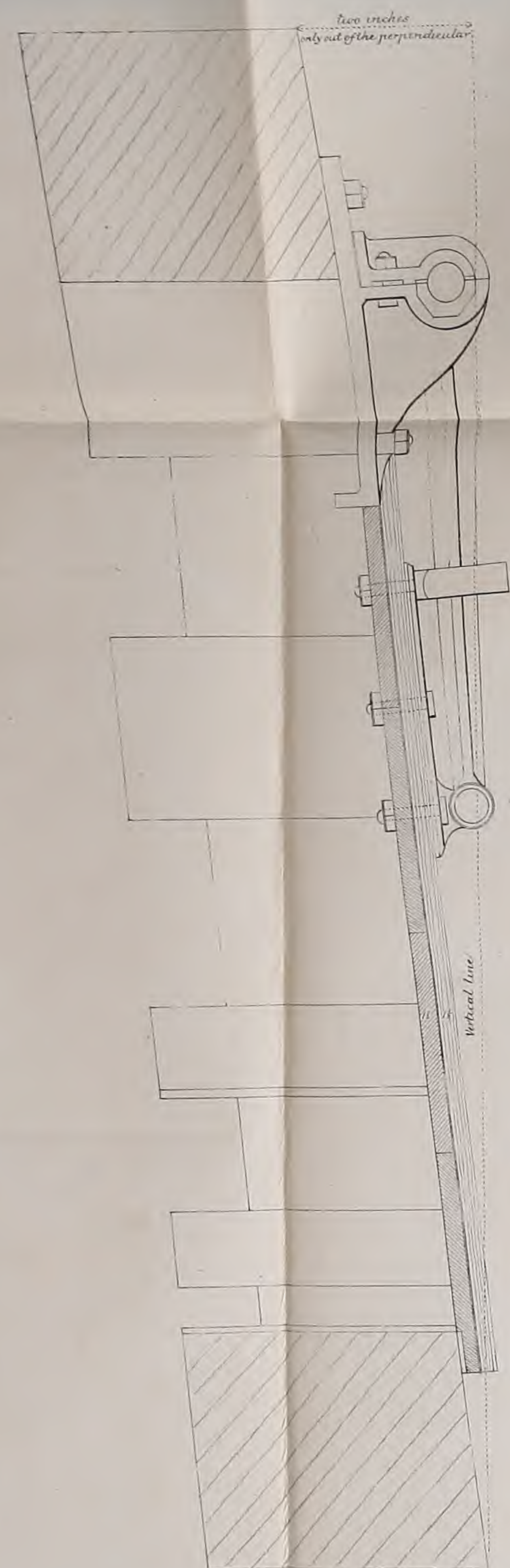
C i r c u l a r C a n a l





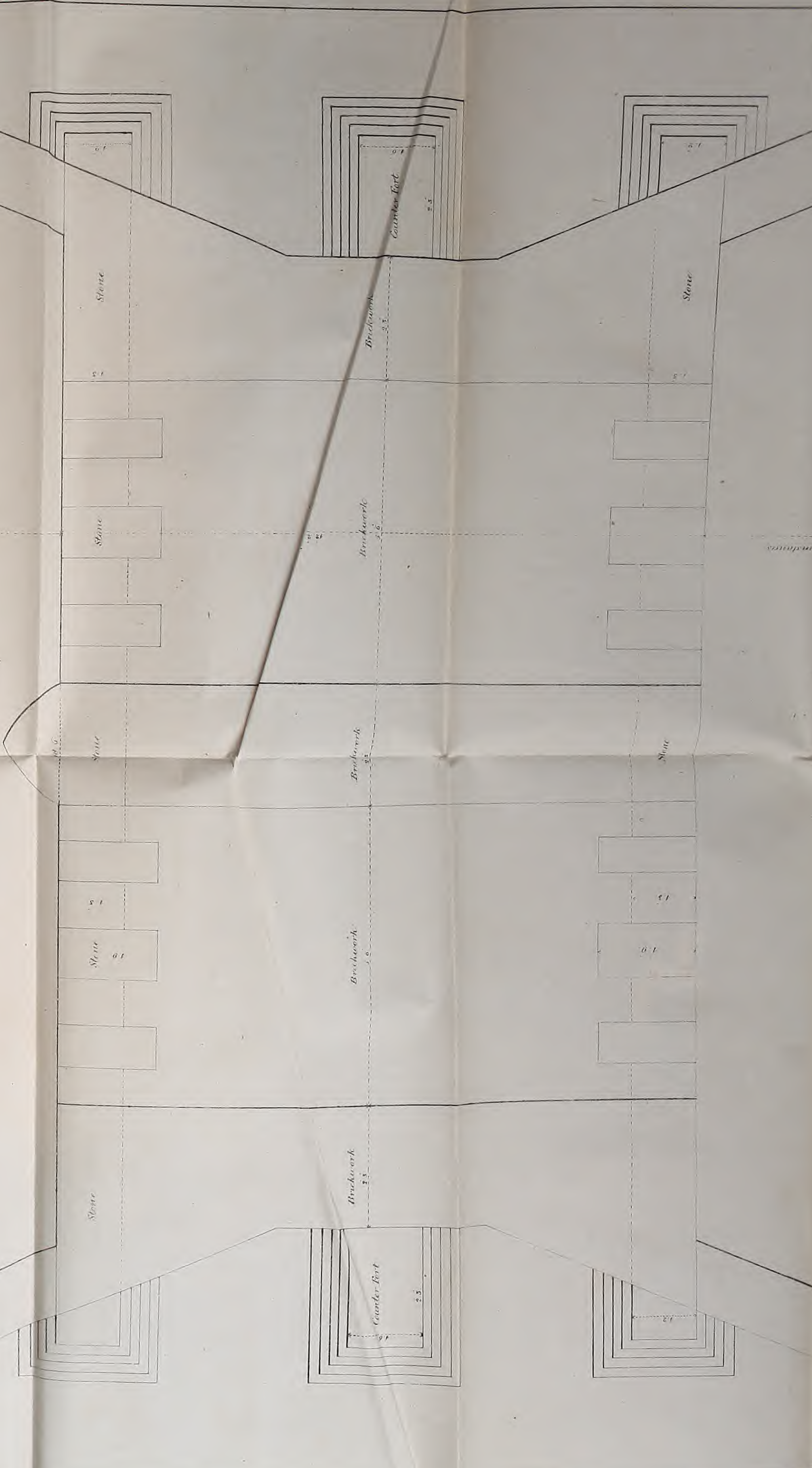
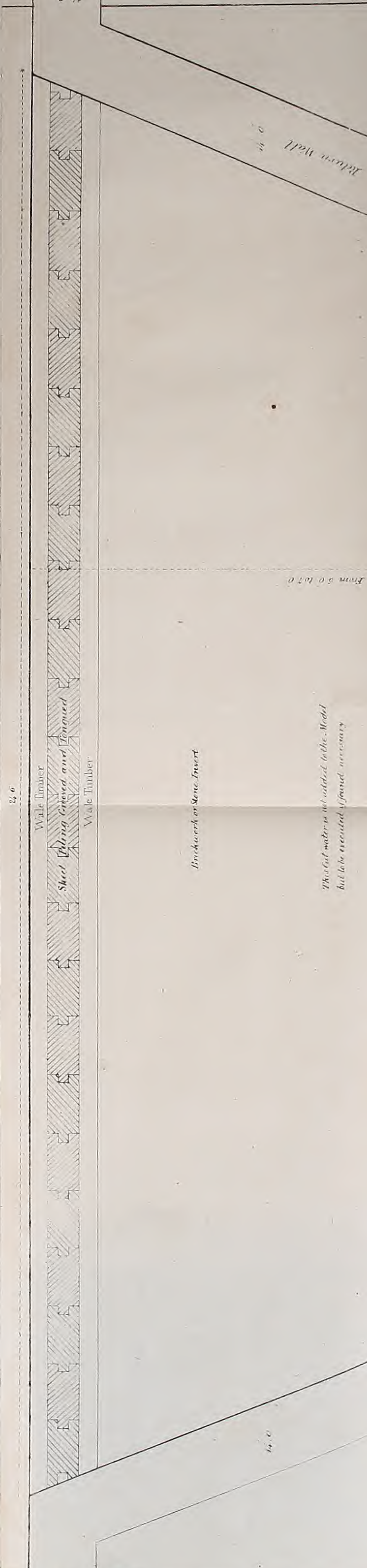
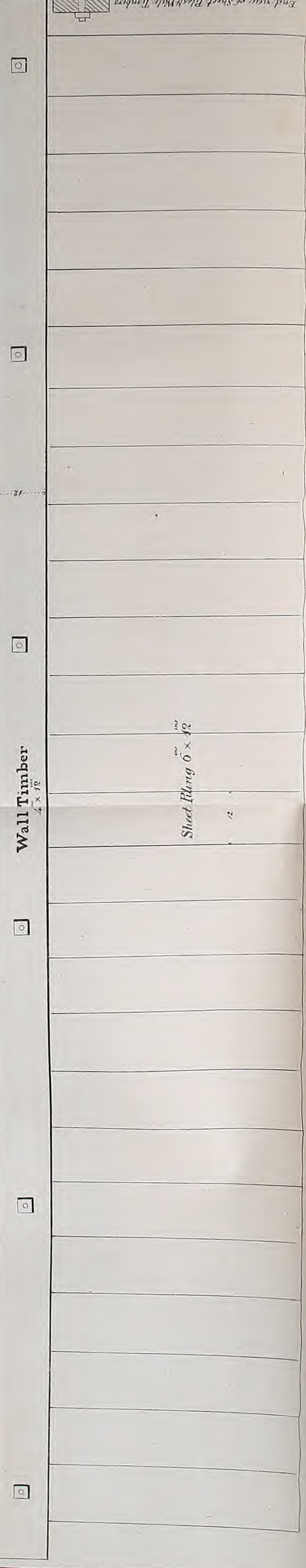
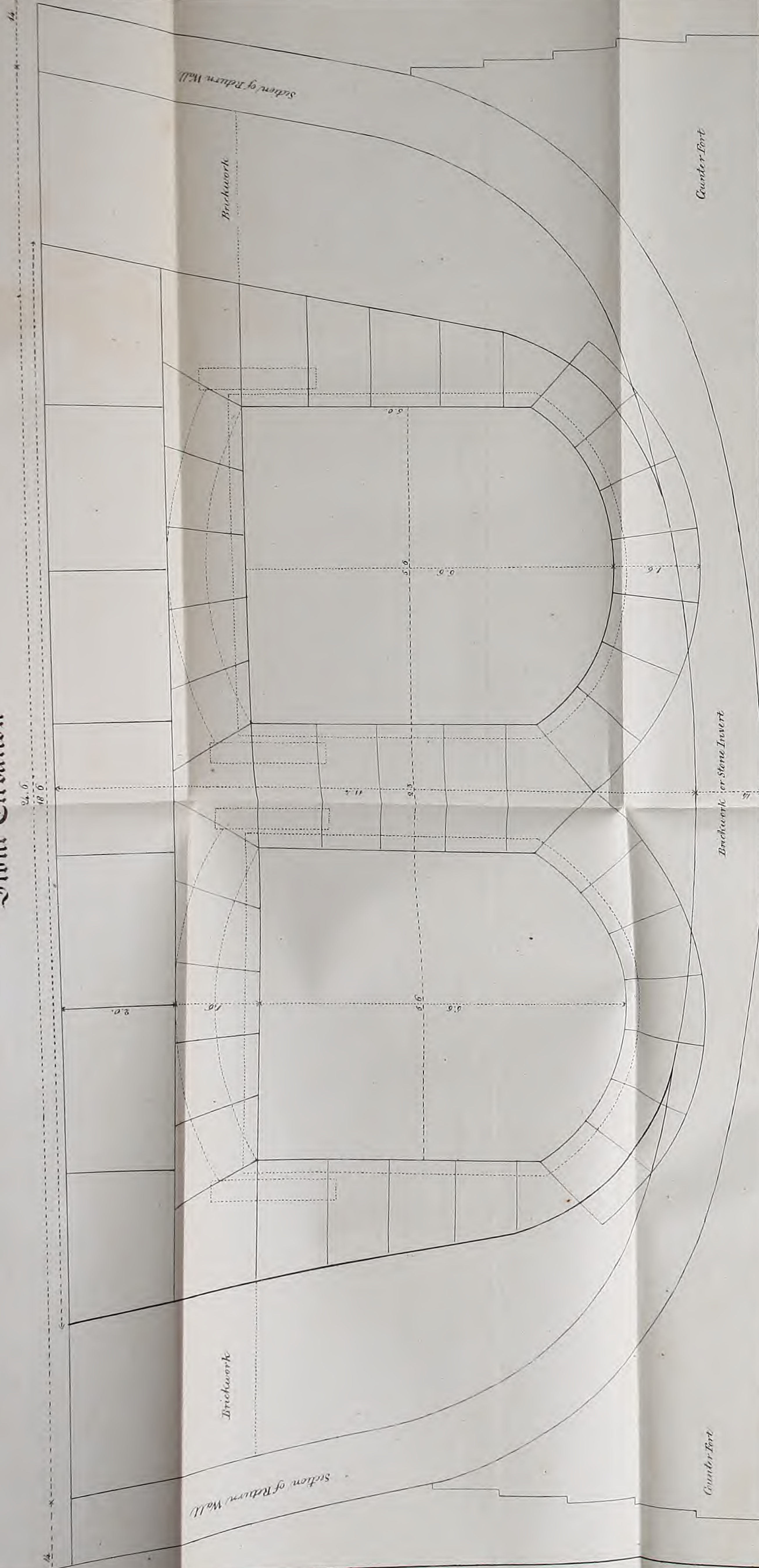
Drawing for the Gates of Sluice

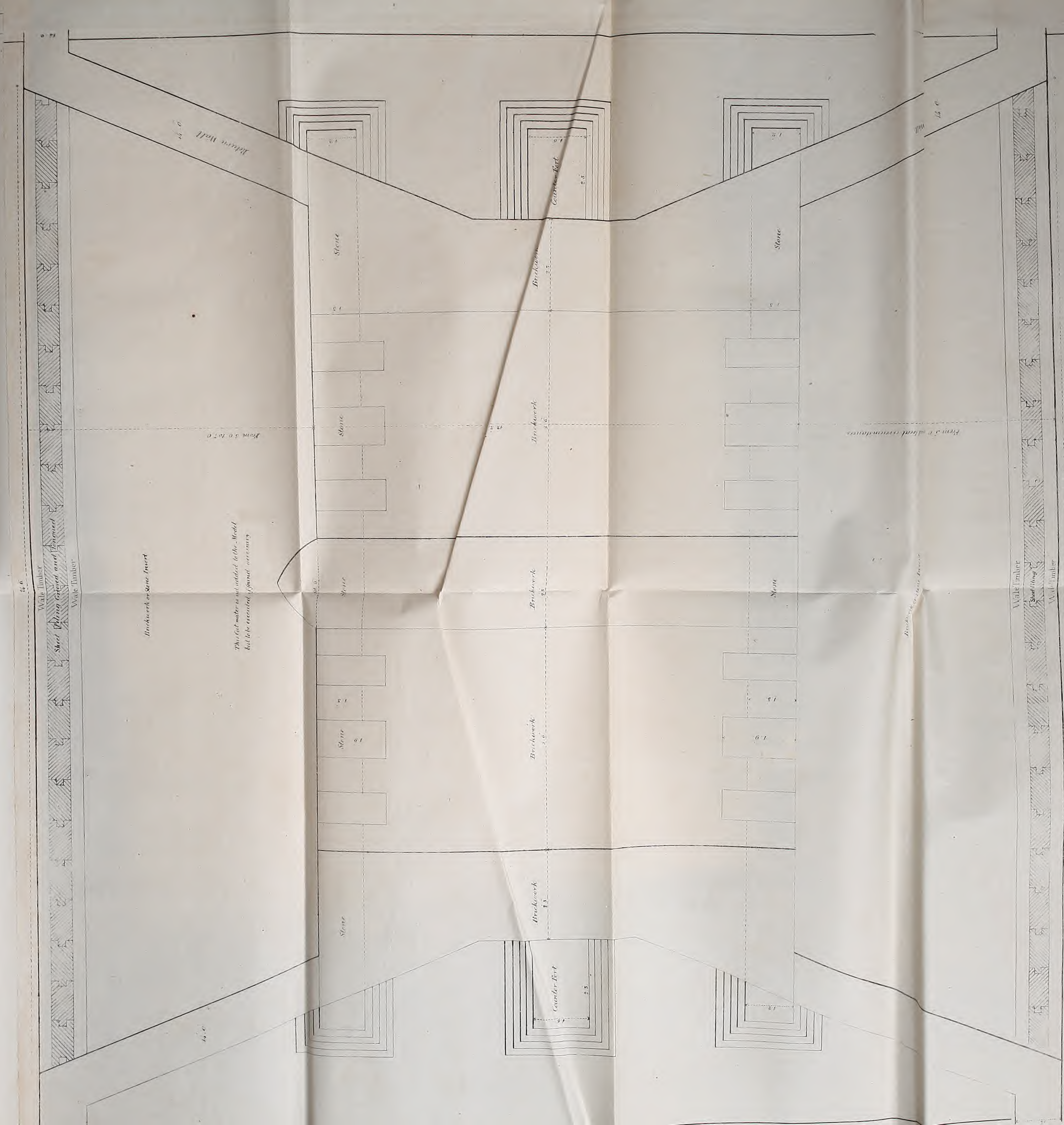
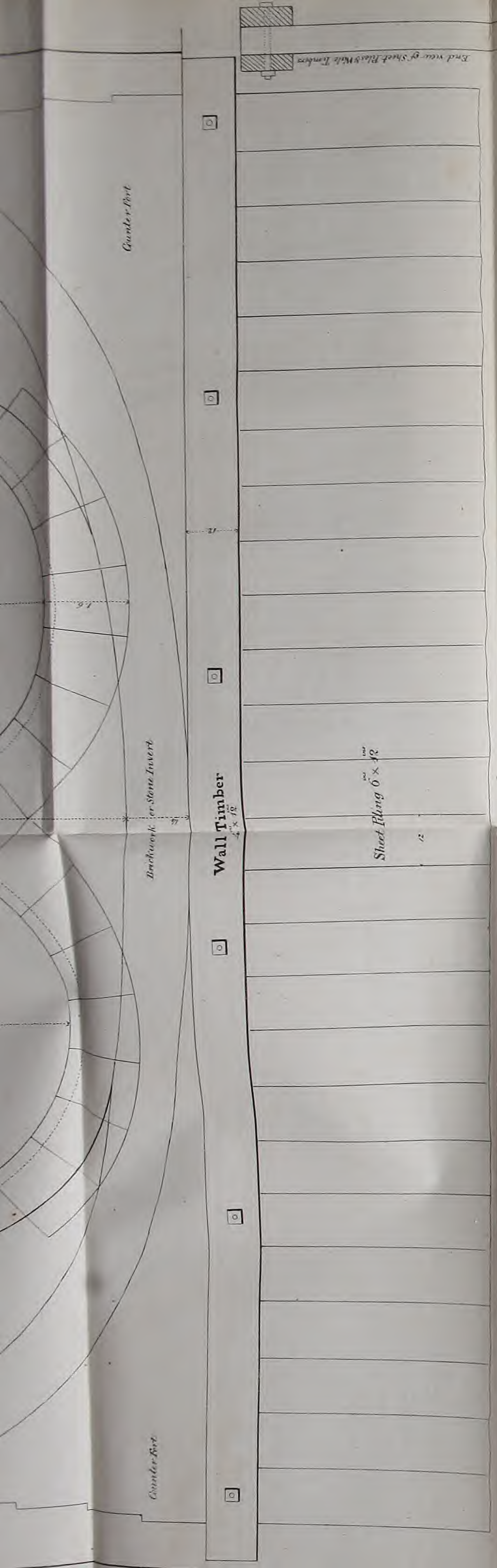
Scale of 1½ Inch to a Foot



The Right Honble
Lord William Cavendish Bentinck

Front Elevation



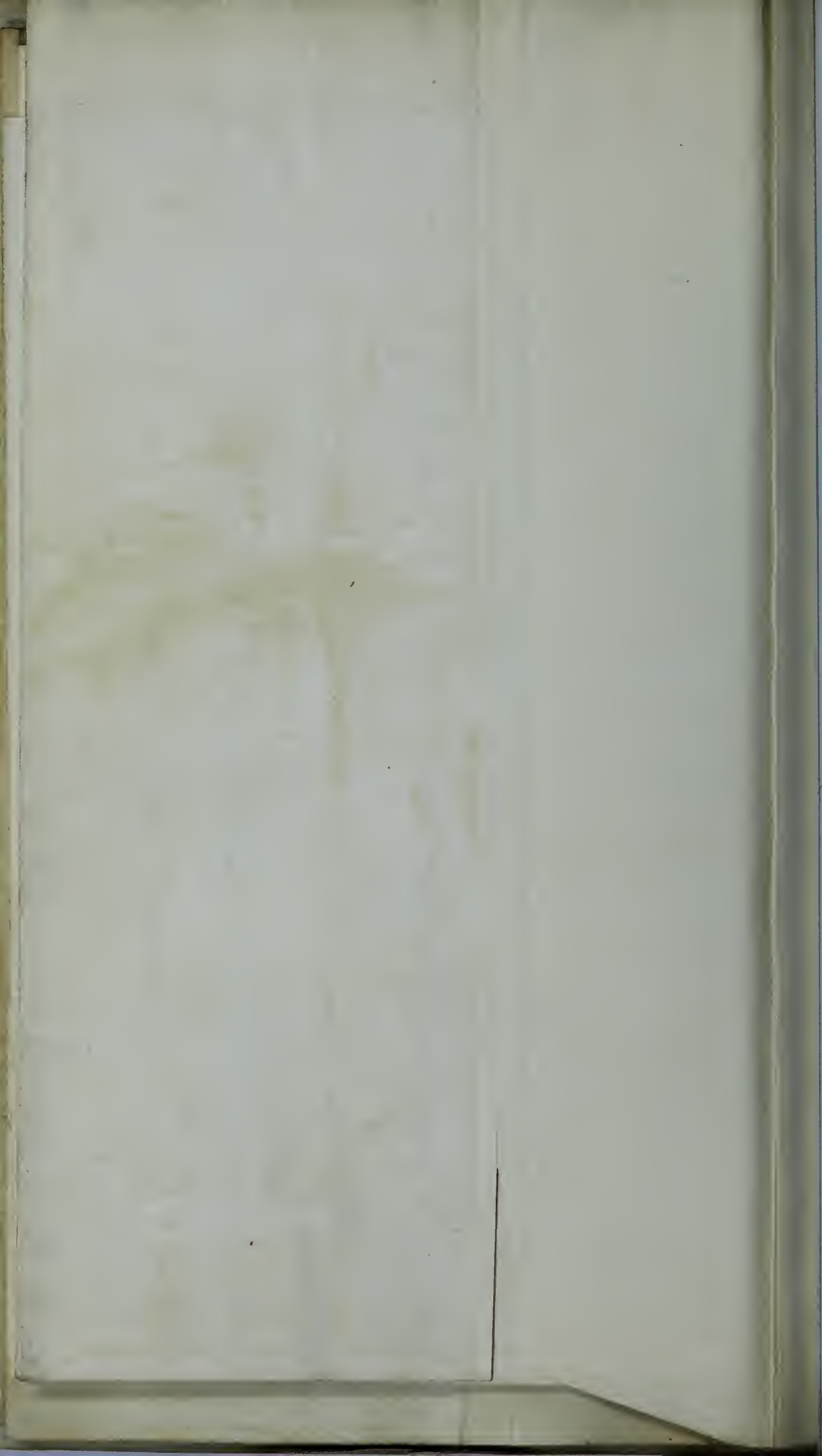


Plan showing PILING, BRICKWORK MASONRY, FOUNDATION &c.

The Right Honble

Lord William Cavendish Bentinck
Thamesford Street, for S^d Scale

S^d W. Turner Clark
Barristers-at-Law, June 1870
Chief Engineer's Office 1872



No. VI.

Government of India Proceedings 5th March, 1835. No. 8.

No. 4614.

(Copies.)

FROM THE MILITARY BOARD,

TO THE HONORABLE SIR C. T. METCALFE, BART.,

Vice-President in Council.

Department of Public Works.

HONORABLE SIR,

Fort William, 7th February, 1834.

With reference to the accompanying* Documents, relative to the Drainage of the Salt Water Lake, and to the improvement of the Canal, we beg to report the result of the consideration which we have bestowed on the subject.

2. As a preliminary step, we referred the subject for report to Captains Forbes and Thomson and Mr. Prinsep.—Copies of the Letter to the Committee, and of their Report, together with the Papers connected with it, are submitted for the information of Government.

3. We have taken these Papers into our attentive consideration, and we beg to forward the Minutes recorded by us on the subject, as conveying the individual opinions of the Members.

We have the honor to be, &c.

(Signed) T. ANBURY, *Col. Chief Eng.*
 „ A. GALLOWAY, *Lieut.-Col. M.M.B.*
 „ D. M'FARLAN, *Chief Mag. M.M.B.*
 „ J. CRAIGIE, *M.M.B.*

The Board submit a Report relative to the Drainage of the Salt Water Lake.

No. VI. (A.)

Government of India Proceedings 5th March, 1835. No. 9.

No. 2378.

FROM THE SECRETARY MILITARY BOARD,

TO THE COMMITTEE. [To wit, Capt. Forbes, Capt. Thomson and Mr. Prinsep.]

GENTLEMEN,

Fort William, 27th September, 1833.

I am directed by the Military Board to transmit to you the accompanying Papers, (13 in number) on the subject of Draining the Salt Water Lake, and to request you will form yourselves into a Committee, and report your opinion on the following points:—

First.—As to the expediency of undertaking the work, with reference to its probable influence on the health of Calcutta, and to the return which may be expected for the outlay; on the latter point, information may be obtained from the Revenue Authorities, and from Mr. Dampier, Commissioner in the Sunderbunds.

Second.—On the best mode of executing the work.

Third.—On the expense, and length of time that would be required for its completion.

Lastly.—On the effect it would have on the Drainage of Calcutta—proposing such means for obviating any difficulties, in this respect, as may occur to your Committee.

[* To wit, those marked I to III, inclusive.—J. M.]

No. VI. (B.)

Government of India Proceedings 5th March, 1835. No.

FROM THE COMMITTEE, [To wit, the above Committee]

TO CAPTAIN G. YOUNG,

Secretary to the Military Board.

SIR,

Calcutta, 11th January, 1834.

Having, as directed by your letter dated 27th September, formed ourselves into a Committee for the consideration of the questions proposed by the Military Board, respecting the Drainage of the Salt Water Lake, we under the heads stated in the margin, have the honor of submitting the conclusion, which the investigation of the subject we have had it in our power to make, appears to authorize.

Q. 1. As to the expediency of undertaking the work with reference to its probable influence on the health of Calcutta?

A. Fortified by the opinions of Medical men, we have reason to believe that entirely embanking out salt and brackish water, and effectually draining off rain and alluvion-charged river water from a surface of forty square miles, a great part of which is now daily overflowed and receded from by the tide, an area included in and surrounding the Salt Water Lakes, and lying to the South-eastward (and for Nine months of the year to Windward) of Calcutta, will most materially improve its salubrity, and that of the country adjacent. The embankments adapted for effecting this object, and aided by means of drainage, also serving to reclaim, for cultivation, the greater portion of the above area, would run, as represented in the accompanying sketch, transversely nearly in the direction D C B F G, and along both sides of the Canal, as it passes through the Lake A B E F. The space, colored blue in the sketch, marks the extent of surface protected from the source of insalubrity alluded to, and rendered susceptible of cultivation.

Q. 2. What return might be expected when the Lake was drained as far as practicable?

A. Although it would be difficult to appreciate the improvement thus rendered to the healthiness of the Capital, or accurately to estimate the value of the reclaimed land, the annexed Statements, of the Executive Officer, incline us to believe that the attainment of the important objects contemplated, may be effected with a return of 10 per cent on the outlay.

Q. 3. The best mode of executing the work?

A. By embanking out the salt water, as above described, and by providing sluices for the discharge, at ebb tide, of rain water or of alluvion-charged water, admitted by the Canal and by a feeder, joining the Hooghly and the upper end of the Lake, for the purposes of irrigation, of ameliorating the soil, and of raising the level of the bed of the Lakes by warping.

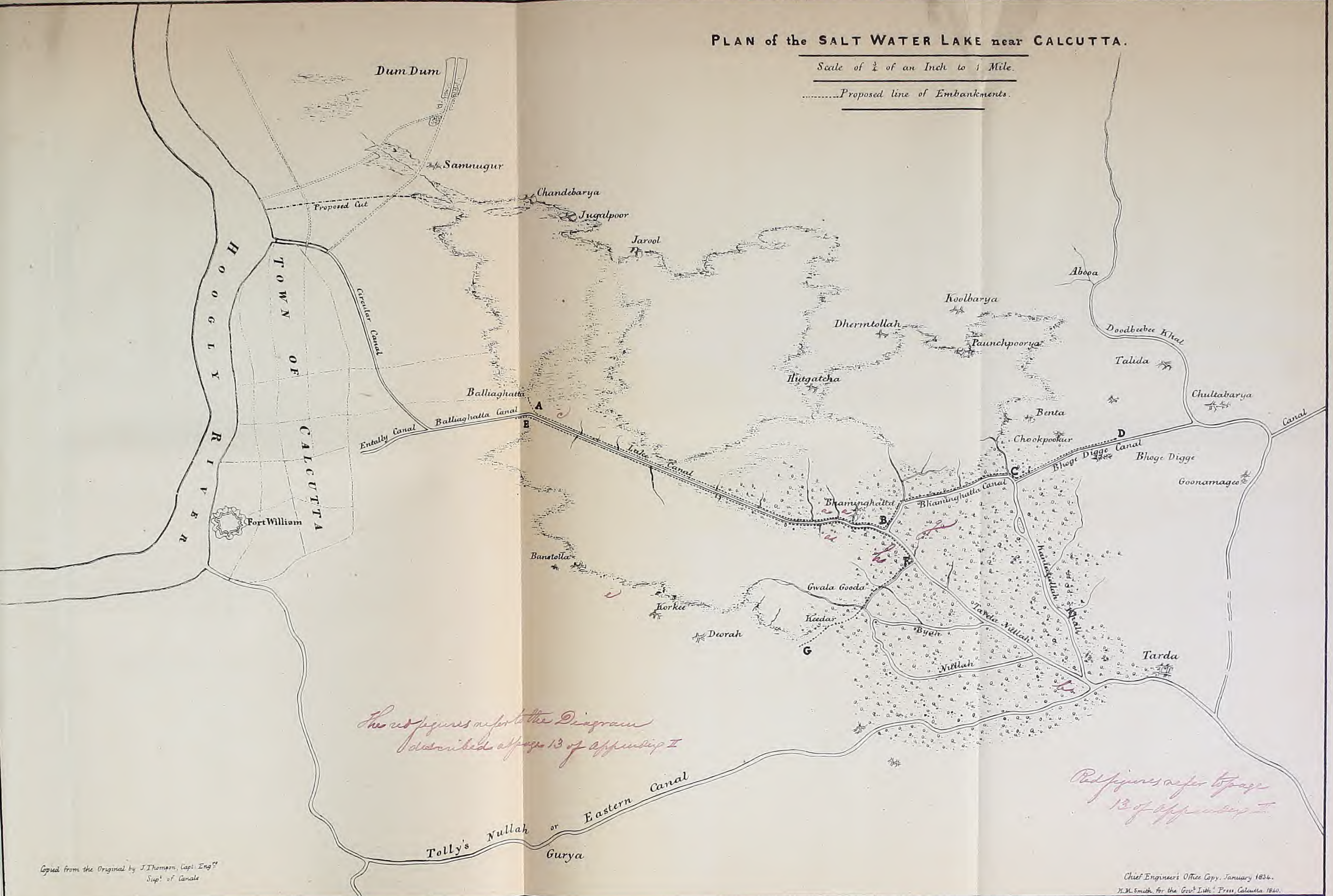
Q. 4. What would be the expense?

A. Exclusive of the purchase of land, the subjoined Estimate, prepared by Captain Thomson, induces us to conclude that the probable expense of the requisite works, exclusive of a Feeder, (separately estimated for) will be Sicca Rupees 200,000.

PLAN of the SALT WATER LAKE near CALCUTTA.

Scale of $\frac{1}{2}$ of an Inch to 1 Mile.

.....Proposed line of Embankments.



Copied from the Original by J. Thompson, Capt. Eng^r
Sup^t of Canals

Printed at the Gov^t Litho Press, Calcutta, 1834

Plan pertaining to the Report dated 11th June 1834 of the Committee (to wit Captⁿ W N Forbes Captⁿ J Thompson & J^s Prinsep Esq^{rs} appointed to enquire into the drainage of the Salt Water Lake

Chief Engineer's Office Copy, January 1834.
H. M. Smith for the Gov^t Litho Press, Calcutta, 1840.

Q. 5. Length of time that would be required for its completion?

A. The embankments between the nullahs may be immediately commenced; and when the requisite information has been procured, lands purchased, and materials collected, which probably cannot be accomplished in less than three years, the completion of the embankments, the construction of a new feeder, of drains, dams, and sluices, may be completed in two years more, or totally in five years from the time the entire work was sanctioned.

Q. 6. Probable effect on the Drainage of Calcutta.

A. The Drainage of that part of Calcutta, lying to the Northward of the Durrumtollah, would not in any way be affected by the works proposed; and the drainage of the ground, situated to the Southward of this street, might be much improved by them, as they would afford it an increased fall of from two to three feet.

(True Copies)

(Signed) G. YOUNG,
Secretary Military Board.

No. VI. (B 1.)

Description of the Ground lying South-eastward from Calcutta.—11th January, 1834.

The general Level of the East bank of the Hoogley, at and near Calcutta, where not artificially raised, is about + 13 or + 14 of Captain Prinsep's gauge. The ground slopes inland from 2 to 4 feet in a mile until it meets the general Level of the country, which varies from + 8 to + 1, the average Level of the cultivation being about + 3. These facts are known principally from Levels taken at Calcutta, and between Tolly's Nullah and Diamond Harbour, by the late Major Schalch.

There have been no instrumental Levels taken between Calcutta and the ground at Bhamunghatta or Tarda: but the general Level of the country, with reference to the rise and fall of the tides in the channels which run through it, is known within one foot—which is the knowledge of most importance in the present inquiry.

That part of the country, between Bhamunghatta and Tarda, which is the out-fall of the Lakes, and which is covered with jungle, is 1 foot 6 inches under water, in high tides, during the rainy season, and about 6 inches above the highest rise of the tides in the dry weather. These Levels refer to the banks of the channels of the Tarda Nullahs; the interior of the jungle is supposed to be 1 foot lower.

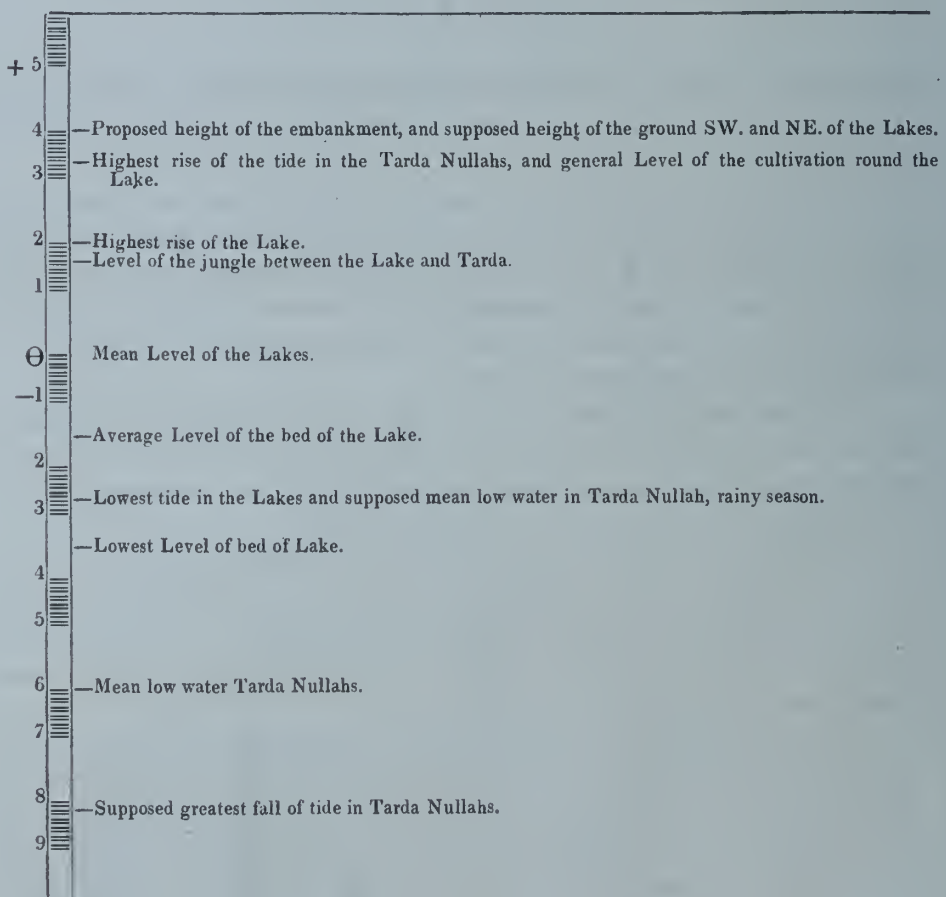
The lowest fall of the tide below the banks of these channels is 10 feet; the mean low water for 8 months in the year, about 7 feet 9 inches; at which time the mean lift of the tide is about 6 feet, or 1 foot 9 inches below the banks. It is supposed that this mean high water in the dry weather is about the Zero of Captain Prinsep's gauge—but the correctness or otherwise of this supposition is not of much importance to the practicability of Draining the Lake.

BHAMUNGHATTA GAUGE.

	feet	inches
Ground near Bhamunghatta.	9	3
Level of jungle.	8	9
Mean height of tide in dry weather (or Zero).	7	0
Mean fall of ditto in ditto.	1	0
Greatest rise in rains.	10	3
Ditto, fall in dry weather.	1	3
		6 0
		11 6

The Level of the Ground to the North of Tolly's Nullah and South-west from the Lake, is rather high, being perhaps $+ 4$. The ground also about Govnamagee and Chutabarya is about the same Level; and there is a piece of ground, perhaps equally high, running between the North-east side of the Lakes and the Doodbeebie khaul. It is worthy of remark, that this khaul is dammed up between Govnamagee and Tarda, and that it generally flows South, and ebbs North, notwithstanding its communications with the Tarda Nullahs by means of the Bhogdiggee Canal. There is little difficulty in accounting for this anomaly and for the Bhamunghatta Canal ebbing Eastward, by the influence of the Lakes requiring a longer time to run out, and consequently retaining the Tarda Nullahs on a higher Level than those to the Eastward, which are not so influenced. The soil of the country with which the embankments will be formed, is rather favourable to that purpose—being a very stiff black clay, impervious to water while it remains moist; which moisture may be retained by encouraging vegetation on the surface.

LEVELS REFERRED TO IN THE FOREGOING DESCRIPTION.

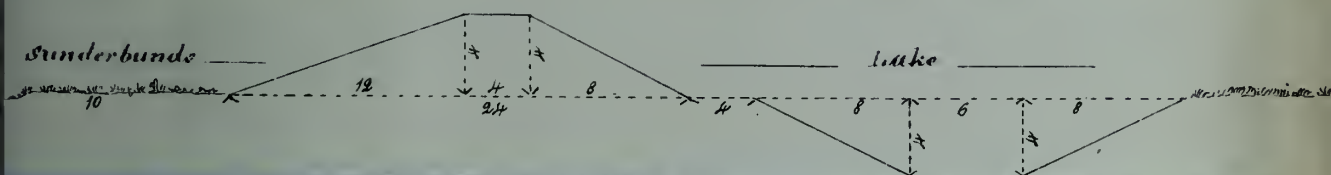


J. THOMSON, *Captain,*
Superintendent of Canals,

No. VI. (B 2.)

Rough Estimate of the probable expense of Draining the Salt Water Lakes, agreeably to the Plan recommended in the foregoing Report.

Calcutta, 11th January, 1834.

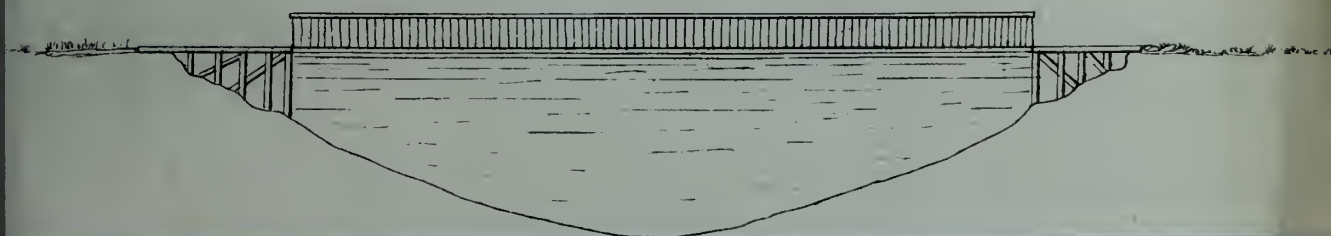
SECTION OF EMBANKMENT.
Section of Embankment

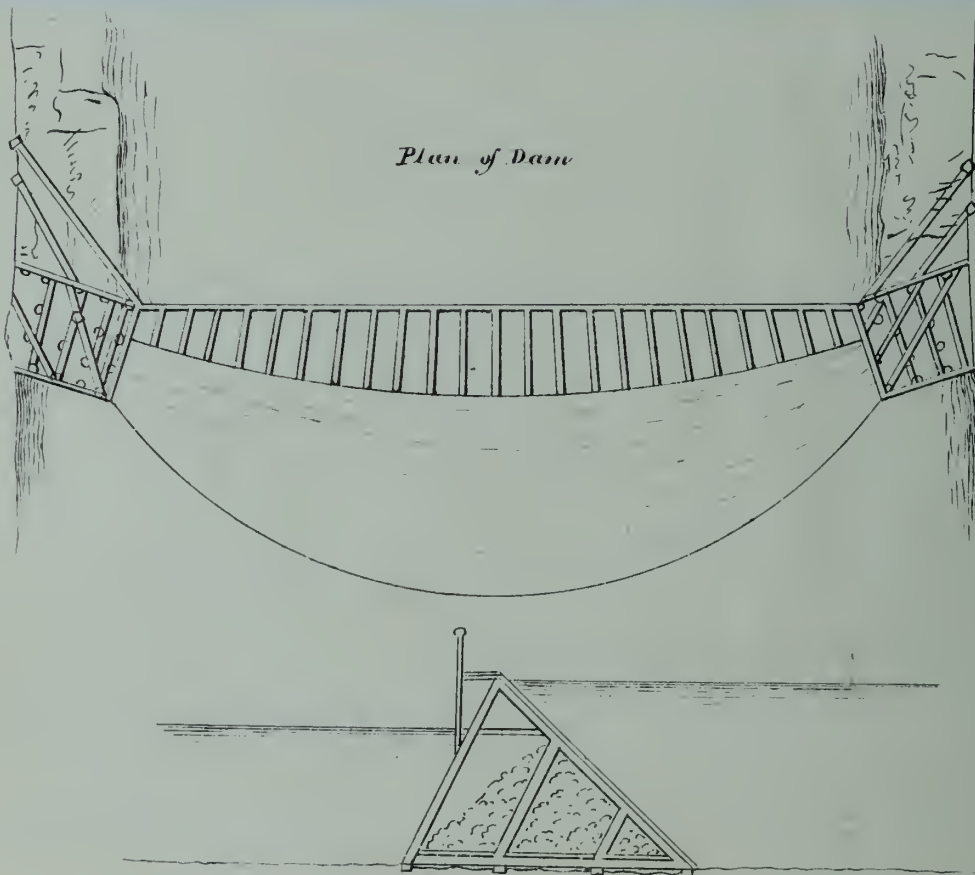
The Embankment is proposed to be 4 feet high with a base of 24 feet; the general Level of the ground on which it will have to be raised, is about Zero,—requiring a section of 56 sq. feet.

The total length of Embankment is 25,000 yards, inclusive of the banks of the Bhamunghatta and Bhogdiggie Canals, which will require very little work to convert them into sufficient embankments. An Embankment of this section may be executed for 80 Rs. the 100 running yards, including the damming up of all Nullahs not exceeding 6 feet in depth, and raising the ground, now under water, by bringing the earth from an average distance of 2 miles—25,000 yards at 80 Rs. per 100 yards=20,000 Rs.

Embanking
20,000 Rs.

There are 4 large Nullahs to be dammed up, and about 30 smaller ones, the most formidable of which is the Byah Nullah; this, at its outlet from the Lake, is 100 feet wide, 20 feet deep at high water, and 14 feet at low water, and the greatest difference of Level to be expected between the water on each side of the dam, being 10 feet, the pressure to be sustained by it will be about 200 tons. Two modes of damming up the Byah Nullah have been suggested:—one by means of piling—the cost of which is estimated at 20,000 Rs.; the work being difficult of [execution]* excavation, and requiring much time and attention,—on this plan the damming the 4 Nullahs would cost 70,000 Rs:—the other by means of a wooden frame, constructed at any convenient place, and floated to that part of the Nullah proposed to be dammed, where it would be sunk by means of earth, and retained in its place by abutments, formed of piles, and by cables attached to stakes on the banks; the current being stopped by this means an earthen bund could be carried across, after which the wooden dam may be floated to another Nullah for the same purpose.

* Sic in Original.
J. M.*Elevation of Dam*



ESTIMATE FOR WOODEN DAM.

25 Frames @ 200 Rs. each.	...	...	...	...	5 000
900 Running feet of beams and struts (12 × 12) @ 2.	...	...	...	...	1,800
3200 sq. feet of planking 3 in. @ 1.	...	...	...	...	3,200
2 Tons of Iron bolts @ 500.	...	...	...	...	1,000
	...	...	...	...	<u>11,000</u>

Draining one Nullah.

250 Feet of piles 10 Dr. @ 4 Rs. per foot.	...	...	...	...	1,000
150 Feet of string pieces @ 2.	...	...	...	...	300
100 Tons of ballast @ 4.	...	...	...	...	400
Fixing dam by cables.	...	...	...	...	400
1,50,000 cubic feet in earthen bund.	...	...	...	...	300
Contingencies.	...	...	...	...	600
					<u>3,000</u>
3' more Nullahs.	...	...	...	...	9,000
30 Smaller Nullahs @ 300 Rs.	...	...	...	...	9,000
					<u>21,000</u>

Damming Nullahs
32,000.

Total expenses of making Dams. 32,000

It may be remarked, that the Nullahs proposed to be dammed, could not be embanked in the manner that the Lake Channel can, because they issue from the deepest part of the Lakes and have no defined banks.

Draining Sluices.

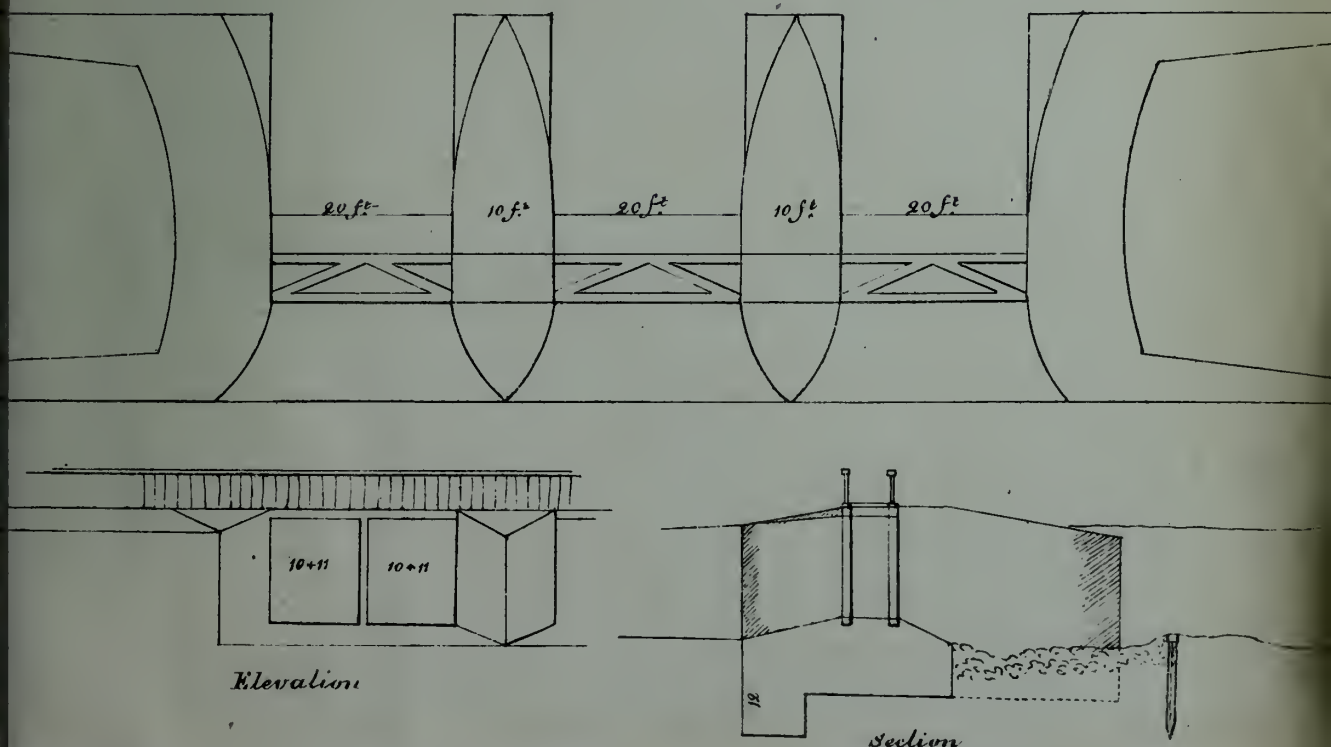
The number of Sluices considered necessary to drain off a fall of 3 inches of rain in the 24 hours from a surface of 40 sq. miles, is 16 (each 20×10); they are proposed to be situated as follows:—5 in the vicinity of the Byah Nullah; 7 near Bhaminghatta; and 4 near the Kantatullah khaul. The description of sluice estimated for, is the self-acting sluice in general use, with two gates on vertical hinges. But the details will require much consideration before the plan is finally determined on. It is proposed to lay the sill of the sluice at 8 of Captain Prinsep's gauge.

Estimate for a Sluice with 3 openings.

The brickwork contains 50,000 cubic feet, which, including excavating and draining, may be done for 16 Rs.						8,000
350 Cubic feet of teak framing @ 3 Rs.	...	...	...	...	...	1,050
600 sq. feet of sluice gates not coppered @ $\frac{3}{8}$	...	...	...	...	...	2,100
600 sq. feet of sheet piling ... @ $\frac{3}{8}$	...	...	...	...	...	2,100
200 tons of ballast. ... @ $\frac{4}{0}$	...	...	...	...	...	800
Contingencies. ...	...	...	...	...	...	950
Total,						15,000

Plan of Sluices.

Plan of Sluices



Draining Sluices
82,000.

The 5 sluices on the Byah Nullah.	26,000
7 near Bhaminghatta.	36,000
4 near Koantatulla khaul.	20,000
Total, ...	82,000

The Feeder proposed to bring water from the River Hoogley to the Northern end of the Lake is supposed to be of the size and description estimated for by the late Captain Prinsep, and will probably cost,

Cutting Canal.	23,000
4 Bridges or tunnels with sluices at one of them.	40,000
Contingencies.	7,000
	70,000
Purchased land about 800 beegahs.	1,00,000
	4,70,000

No. VI. (c.)

[MINUTES OF THE MILITARY BOARD.]

Government of India, Proceedings 5th March, 1835. No. 10.

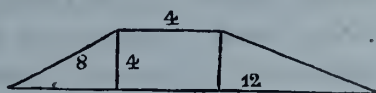
SALT WATER LAKE.—DRAINING AND WARPING.

Minute by Lieut.
Col. Galloway

The scheme presented by the Committee is chiefly confined, save the Feeder, to the process of *draining* the Lake, not of warping. But, I apprehend, the warping will be found indispensable, both in regard to the advantage proposed as to increased salubrity of climate, and for the purpose of cultivation. For, supposing the embankments, projected by the Committee, to be formed, with their sluices all in operation, is it imagined that the surface of the bed of this extensive Lake, throughout the interior of its area, is so even, and that its general level affords such a slope towards those embankments and sluices, that you have only to open these, and the water will drain off as from the glacis of Fort William. No! it will be found that the bottom of these Lakes (for there are three almost distinct ones) is greatly unequal in depth; that your drains through these embankments would not reach the interior cavities; and that after your draining off the water, as proposed,—all the water that would thus come off,—you would leave the surface in a predicament infinitely more noxious than it ever is in now, in regard to the production of malaria; that is, it would be studded with pools of stagnant and dead salt water, instead of being, as now, a whole surface of living brine. And consequently that a great portion of the area would thus be quite unfit for cultivation; and could not be made use of without an expense, which would most likely absorb all the profits contemplated by this Committee. My opinion, therefore, is,

that the process of *warping* should at the first be commenced:—if this succeeded, there would be no necessity whatever for draining, as a separate and preliminary measure—for, as the bottom became elevated, the water would naturally recede—and, in order to do this, I apprehend all that is necessary, is to cut a feeder, as projected, from the Hoogly, near Cossypoor, for the purpose of admitting the water, and simultaneously forming warping bunds. But I would by no means recommend that the warping of the whole Lake be attempted at once; the agitation, by the wind, of the water on so large a surface, would impede the deposit of silt. I would therefore, and for many other reasons, commence by throwing an embankment across, between the first and second divisions of the Lake, see from *A* on the sketch, at Balliaghatta on the south, to *H*, at the village of Jarool on the north of the Lake.—This embankment should be used as a *weir-dam*, of a height sufficient to retain the feeder water, charged with deposit, until the precipitation of the deposit had taken place: after which it would, were the height of the dam duly proportioned, suffer the clear water to flow over the embankment. If this were found difficult, on account of the washing down of the earth,—then the embankment must be raised above the level of the water, and the necessary outlets could be adjusted by means of top sluices, with overfalls of coarse wooden blocks; as a temporary structure only would be requisite.

2. The distance between Balliaghatta and Jarool, on the sketch, appears to be about 5000 yards; and, according to Captain Thomson's estimate, an embankment of four feet in height, four feet at top, and twenty-four feet bottom, would cost, even if the earth had to be carried two miles, about 80 Rs. per 100 yards in length; consequently for 5000 yards, 4000 rupees only would be required; but this embankment would hardly need to be so high, for the greater part of its course.



Supposing however the cost of embankments to be Rs. 4,000

Add the estimate for excavating the feeder, which Captain Prinsep reckons

at per mile Rupees 7,680, the section being equal to discharge, at 6

feet deep, a section of water of 200 square feet; the length, about 3

miles, amounts to *Rs. 23,640

For three bridges, with a sluice at one, 45,000

[*Sic. in original.
—J. M.]

The total cost would be Sa. Rs. 72,640

3. No account is here taken of the cost of purchasing ground for the feeder, because that is utterly unknown. But, exclusively of ground here, we should have, for a comparatively small sum, the commencement of the process secured, and a very principal item of expence, namely, the feeder canal, defrayed. If successful, we should reclaim no less than 10,640 beegahs of the most valuable portion of the Lake, because it is nearest the Town: this, if reclaimed by warping, would be immediately fit for cultivation. It would be rich soil, and very valuable; and would do far more than defray the expence; and after this, further progress would be easy and certain—no time would be lost, no expence incurred that would not be turned to account. The second division of the Lake, containing about 12,000 beegahs, could hereafter be warped in the same way, and by means of the same feeder, merely by raising the banks of it as it passed through the portion already warped up, and throwing an embankment across by Baminghatta and Hatgatcha, which would cost about 4000 more. Thus we should proceed I think, with greater satisfaction and with a better hope of ultimate success. Draining, as a preparatory process, is unnecessary, for if

we have a fall from the Hoogly sufficient to bring in water, charged with deposit, that water will, of itself, expel the salt water, and fill up its place with deposit—when the water will of course recede; and the great advantage of warping, in such cases, is, that it equalizes the level of the bottom. Where the greatest depth is, there will there be the greatest quantity of charged-water, and consequently of deposit brought—whilst it leaves the finest soil fit for immediate cultivation.

4. But we must not suppose that the above is the only expence that will attend warping. To be effectively done, much management will be required to convey the alluvion charged water from the feeder, after it enters into the Lake, in branch or lateral directions so as to spread, as much as possible, over the surface; yet it is impossible to suppose, but that so large a body of water, as that admitted by such a feeder, charged, as it will be, with deposit, forced here to stagnate, and consequently to drop its deposit, can fail to produce the desired effect with proper management, and I do not anticipate that this management will cost any inordinate sum—but it is unnecessary to enlarge upon this part of the work.

5. The Eastern portion of the Lake, or that which in some of the maps is called “Kaleedar Dappa,” I do not think we ought at present to take into consideration. It is probably deep in many places, and would be difficult to drain; and it could not be warped from the Hoogly, because it is too far off, and upon the same level, so that no current, capable of carrying deposits, could be thrown upon it. I would therefore suffer it, for the present at least, to remain to perform, what the whole now does, a waste reservoir for the strong and high tides of the Tarda creek; an use which will be found highly valuable with reference to the Drainage of Calcutta. I would therefore omit the Kaleedar Dappa. But that portion of the Lake which lies on the South side of the present Canal is valuable, and to that I will now solicit attention.

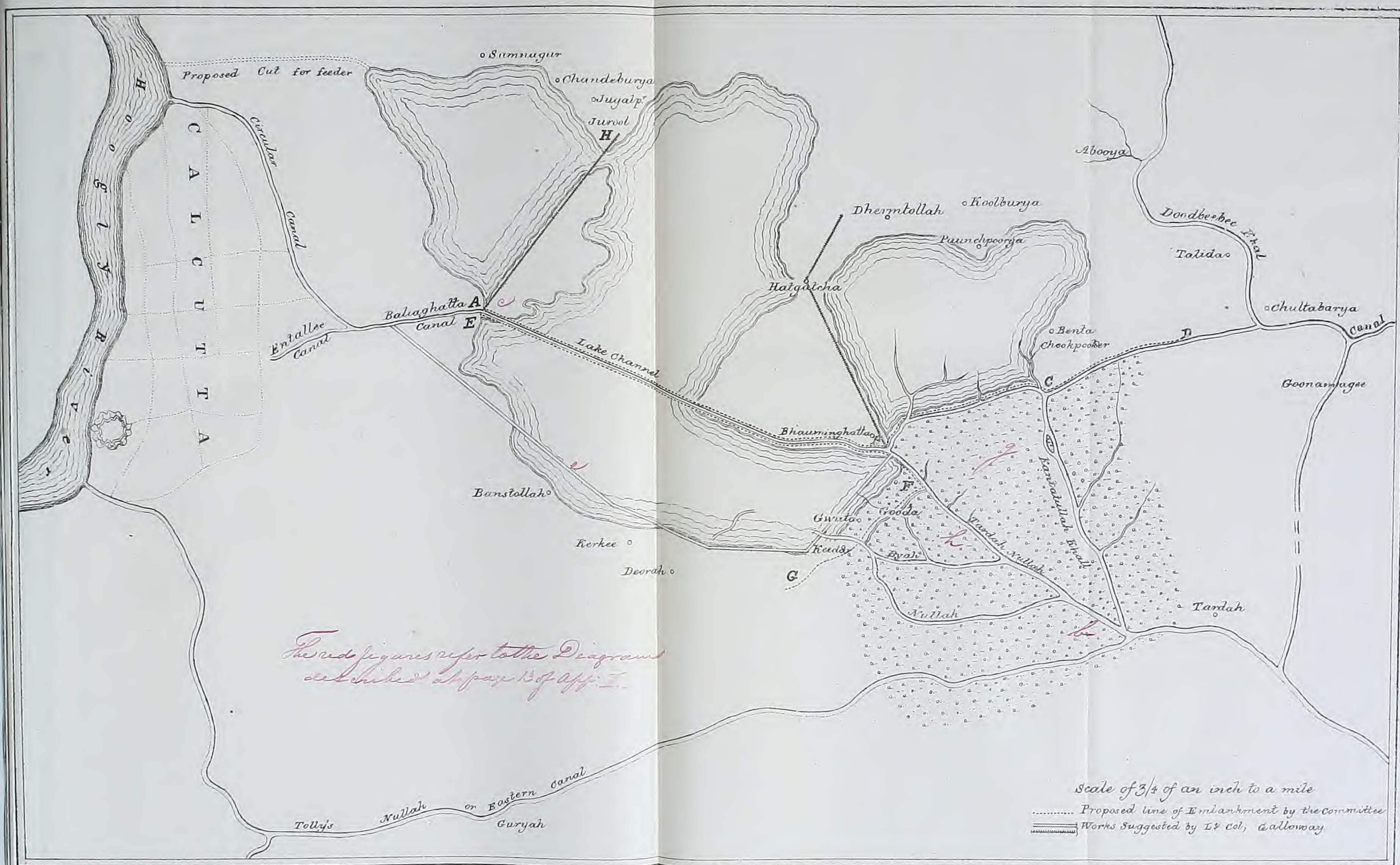
6. I entirely concur in the view taken by the Governor General in regard to the Circular new Canal, which passing towards the Sunderbuns should never have entered the Lake. I have long ago stated* my objections to this part of that scheme; and need therefore not repeat them. But, as observed by his Lordship, if the Canal shall be carried outside of the Lake, through firm ground, not only would a footing be obtained on both sides for tracking; but—were the banks of the Circular Canal capable of resisting the current from the river, and the drainage of the Town properly managed, there would be no necessity whatever for any locks—the entire passage might be left free, as in Tolly’s nullah. In this case however, with reference to the drainage of the Town, advertence must be had to the fact, undoubted,—that the tide will rise higher within the confined channel of the Canal, than when the water is suffered to expend its force into the broad expanse of the Lake. But, as this applies equally to the proposition by the Committee for confining the Canal by double embankments through the Lake, more need not be said on the subject here.

7. The drainage of the Town provided for, every thing is in favor of carrying the Canal outside the Lake. At present no less than six miles of the Canal, to the Eastward of Ballyghatta, passes through the Lake, and is intercepted from all communication with the land; and even were it closed in by means of double embankments, as proposed by this Committee, which appears to me objectionable, and would be very expensive, it would still remain so intercepted until the Southern division of the Lake shall be warped up. Whereas by now bringing the Canal along the Southern border of the Lake, as proposed by the Governor General, it will immediately become open to the whole of that densely peopled portion of the Suburbs of Calcutta, lying to the Eastward of Chowringhee and to the North and East

* [In Minute dated
25th Jan. 1831.—
J. M.]

Plan shewing the Means proposed by Lieut^t Colonel A Galloway, and the Committee /to wit Captⁿ W.N Forbes

Captain J Thomson, and James Prinsep Esq^{re} /for draining the Salt Water Lake.



of Ballygunge—affording, all along its banks, ghats of communication through a space of 8 miles. The line on which this new cut would be made, would commence somewhere near *E* on the Committee's sketch, and pass on to the village of Kerkee, and thence round the South-eastern extremity of the Lake, by Keder and Gwalgoonda to the Tarda nullah. The increase of distance would be, by this route, about $1\frac{1}{2}$ miles, the extent of Canal to be cut, would thus be about eight miles. And to meet this outlay, there would be saved about 19 miles of embankments, viz. the double embankments through the Lake on each side of the Canal, —a very expensive work, miles, 12

Ditto from *G* to *D* per sketch 7

Total miles, 19

whilst the Canal embankment, surrounding the southern division of the Lake and uniting with the embankment proposed by me from Baminghatta to Hatgatcha, the whole of the Lake would at once be cut off from the Sunderbuns and all their tide ways, and could then be dealt with, as to warping and draining, as might be deemed proper.

8. The advantages, in my opinion, which would necessarily result from the adoption of his Lordship's proposition for carrying the Circular Canal on through the firm ground along the Southern verge of the Lake may be stated briefly as follows :—

Firstly,—Provided the drainage of Calcutta can be managed (and the same difficulty, whatever it may be, exists by the Committee's scheme) and that the current from the river in the rains shall not be found too strong for the banks of the Circular Canal, it would remove the necessity for locks altogether.

Secondly,—It would give to the whole suburbs of Calcutta water communication, by admitting of free access, by land, to the banks of the Canal, which is now and by the Committee's scheme, cut off by its passing through the Lake.

Thirdly,—It would secure a current through the Canal, which, falling into an open Lake, now it never can fully have, by which means it would keep itself open—save perhaps at the spot where the Tarda nullah tide would meet that from the Hoogly, and that could, by dredging, be easily kept free.

Fourthly,—It would save entirely all our other present Lock and Canal establishments.

Fifthly,—It would, with reference either to draining or warping of the Salt Water Lake, render superfluous about 19 miles of embankments proposed by this Committee, besides many sluices to be constructed and nullahs proposed to be bunded up.

Sixthly,—It would give us additional means of warping up the Lake by opening sluices from the Canal.

Seventhly,—The Canal might be made highly useful, by means of such sluices, in relieving the drainage of Calcutta, should the tides and freshes in the Hoogly raise the water inconveniently high in the Canal, by affording overfalls for the superabundant water. It is by such means I would propose, in case of necessity, to regulate the drainage of the Town.

Eighthly,—By excluding, for the present, the Eastern portion of the Lake, or Kaleedar Dappa, the strong tides of the Tarda nullah would yet have a large reservoir left to empty themselves in; and thus the drainage of the Town would still continue to be relieved as at present, though not in the same degree.

Ninthly,—The Canal, if cut round the border of the Lake, would enable us by means of its own embankment, embracing the Southern Division of the Lake, and joining on to the

south end of the Hatgatcha bund at Baminghatta, to cut off from the Sunderbuns, and all their tide ways, the whole of the Lake, excepting the Kaleedar Dappa adjoining—and which indeed may be considered as a part of the Sunderbuns. The extent of surface thus to be included within the embankment being estimated as follows :—

1st Western Division beegahs	...	...	...	..	10,640
2nd Eastern Ditto, ditto, about	..	...	...	...	13,440
3rd Southern Ditto, ditto,	...	...	...	...	12,000
Total beegahs					<u>36,080</u>

The [annexed] following sketch will shew more clearly the plan I would submit for consideration.

9. If the foregoing propositions should be adopted, the work of the feeder cut, and also that of the Canal, round the South side of the Lake, may be immediately commenced. In opening a communication between the River however, and the Lake, where, in the space of not quite three miles, there will be in the rains a difference of level of about 12 feet between the surface of the Hoogly, and that of the Lake, the necessary precautions must be taken, by means of a sluice or by a constricted channel, to regulate the influx of water. This is provided for, I observe, in Captain Thomson's estimate.

10. The question of right of property in the Salt Water Lake, this Board is not called upon to discuss; I may observe however, that a Lake of so great expanse, lying *within* the domains of no individual, must be considered as one of those extensive Wastes which never have been specially assessed, and must therefore ever remain at the disposal of Government until it shall be so assessed and disposed of—in like manner as the Sunderbun lands are. I know not indeed why this Lake should not be considered as Sunderbun Waste. There is no boundary, on its Eastern shore, to separate it from and define the limits of the Sunderbuns, half so well marked as its own Western margin. Its water is salt—and thus, and in other respects, it corresponds, in every physical property, with those jungles; and this must in 1793 have been still more obvious.

(Signed) A. GALLOWAY.

True Copy,

(Signed) G. YOUNG,

Secretary Military Board.

No. VI. (D.)

Government of India, Proceedings 5th March 1835. No. 11.

Minute by Chief
Engineer.

I regret, that considering the high authorities under which the report has been framed, I derive no light therefrom, and am rather disappointed. As to the question of "the expediency of undertaking the work with reference to its probable influence on the health of Calcutta," I believe the Committee have arrived at a conclusion which has been reached long since, by a great number, if not all, the medical authorities acquainted with Calcutta and the Salt Lakes in its vicinity; a point I do not feel myself competent to enter upon; however, as the draining, desiccation, or reclaiming of the Lakes, is a measure, independent of the healthiness of Calcutta, much to be encouraged, I should be glad to see the means for progressing the work carried into effect. I agree with the Committee that the mode to be

adopted for effecting this object will be embankments ; but I do not exactly agree with them in the mode of application, at least if the Surveys and Plans (the latest by the late Captain T. Prinsep of Engineers) are correct,—for I am decidedly of opinion the end would be most efficiently and effectually accomplished by a gradual acquisition of soil, rather than by exposing a very considerable line of bund or embankment, in the first instance, to a heavy influx, which must besides endure a considerable force from the reflux, before a permanent bund, or a bund the whole length required, could be substantially (or of any great power of resistance) constructed. A gradual acquirement of *terra firma* would have another advantage, and that of no small consequence, I should imagine, that of bringing the ground, reclaimed, into almost immediate cultivation, and comparative salubrity. I agree with the Committee that both sides of the Eastern Canal, as far as it runs through the Lakes, must be bunded ; and on both sides crossing all the sinuous outlets from the main area of the Lake—leaving, however, out-drains at intervals, until the bund or embankment is so far accomplished as to warrant the general line being committed to its own strength for the resistance of the floods of tide and back waters. A plan for this I have already submitted* to the Governor General.

* [Vide Paper
marked No. V.—
J. M.]

2 From native information I have obtained on the subject, I am inclined to believe that the advantages likely to be derived, in a revenue point of view, would be more considerable, than is, by the executive Engineer, calculated in his Statement.

3 The best mode, I am quite satisfied, of excluding the Salt Water from the Sunderbunds, is, by bunding in the first instance with temporary sluices or outlets for the water at ebb-tides, while the work is in progress,—and these to be stopped up and secured as the bund proceeds : the “alluvion charged water,” will be let off, after it has afforded a silt, by one or two permanent self-acting sluices, as explained in plan. But before a feeder is employed, according to my judgment, the Lakes should be said to be drained or reclaimed, and *then* a feeder, as laid down in both our plans, may be put in operation for warping, assisted by catch water drains where they can be advantageously made along and from the high grounds bounding the Lake to the *Eastward* ; and it appears to me that natural operations have already gradually and almost imperceptibly much reduced the extent of all the Lakes, if, as I said before, the Surveys and Plans are at all entitled to the character of accuracy.

4. I cannot pretend to say any thing regarding the Estimate ; but from consideration, and looking over the several items of the Estimate, I should say that many things therein are not essential, and some considerably above what the requisite work might be done for.

5. The embankments between the nullahs (as I am inclined to understand the Committee, the spaces between the sinuous outlets at present letting off the ebb into the main channel) might certainly be commenced on, almost immediately, on each side the channel through the Lake, but I imagine *not* without materials being forthwith collected ; though I do not thoroughly understand the meaning of the Committee as to the information to be procured and materials collected ; requiring an accomplishment of not less than three years, and “ the completion of the embankment, the construction of a *new feeder*, of drains, dams, and sluices may be completed in two years more ; or totally, in five years from the time the work *was* sanctioned,” this I think requires explanation, at least as far as my comprehension serves me.

6. On the drainage of Calcutta, as referrible to the filling up or reclaiming the Lakes, I conceive it has nothing to do, since the Canal runs between the Town and the Western extremity of the Lake,—but, on that head, I should say that a new grand *tunnel* or *trunk drain* should be constructed to carry off all the drainage of Calcutta towards Tolly’s Canal : but that is quite another question.

Thus much on the Committee's Report.—

On all the ground South-East of Calcutta, there is not I think much to be said. If the North-Eastern and Eastern Lake were completely reclaimed, little difficulty would I imagine be incurred with the South-Eastern part, or that called Byah Tollah. The variations of the tides, according to Captain Thomson's description (No. 1), I have no reason to doubt, and they present nothing objectionable to the question; the ground about Tolly's Nullah, or the Nullah itself, has little to do with the operation of draining the Lakes. The black clay alluded to (the most fortunate matter possible) to be [used] in the bunds, I would not form* as projected; but by means of strong wattling; if afterwards slopes might be deemed requisite, they might be added: my plans† with the Governor General will explain all that.—Regarding the very expensive dams, they are in my humble opinion quite and totally unnecessary, and the means used in damming up much larger channels than the Byah Nullah may be adopted, and I have no doubt with success; and 20,000 rupees be appropriate to other parts of the grand work. I do not understand Captain Thomson's other scheme of "excavation"—and his plan of the dam requires also explanation. The draining scheme I do not acquiesce in—and it is a vastly heavy item; and in my opinion quite unnecessary. The number of draining sluices I consider as not requisite. More than two or three at most will hardly be required; and the plan of the sluices are inordinately costly—considering that they will be merely temporary, and that when the Lakes are reclaimed they will no longer be required. On the whole, I think that the cost of the undertaking has been heedlessly estimated for; and in fact the plan, if it can be called one, altogether undigested and not at all explained.

(Signed) T. ANBURY.

No. VI. (E.)

Government of India, Proceedings 5th March, 1835. No. 11.

The Report of the Committee on the draining and filling up the Salt Water Lakes, is marked by simplicity of plan, and brevity of exposition. It is the joint report of three Engineers of high scientific attainments, and with intimate knowledge of the Lake. It is the result of long consideration, and personal observation of the data on which it is founded. One of the officers (Captain Thomson,) from the appointment which he now holds, may be considered the Engineer likely to be employed in the execution of the work, should it be sanctioned, and therefore willing to be responsible for the success of the plan. A report framed under such circumstances must be entitled to great weight; and it would be impossible, perhaps, to obtain, here, a report that would possess so many recommendations. It is very seldom that three Engineers, of such high attainments, can be found to concur in one plan for the execution of a work of such magnitude and uncertainty:—of the intrinsic character of the report, I shall not venture to speak. I would, however, suggest that the report should be published, and the plan thus thrown open to public discussion and consideration. I conclude that no plan will be adopted that shall not find an Engineer officer, of science, willing to undertake its execution, and to be responsible for its success. It would be a dangerous thing in a work of this kind to prescribe a plan to an Engineer, who would execute it under the conviction that it would fail.

(Signed) JOHN CRAIGIE.

* Sic in Original.
J. M.
† Vide paper marked No. V.—J.M.

No. VI. (F.)

Government of India, Proceedings 5th March, 1835. No. 11.

I regret that other calls on my time prevent me giving to this highly interesting subject the study which is absolutely necessary to a thorough understanding of it. Nevertheless, I feel that it has peculiar claims upon my attention as Chief Magistrate of the Town; and that I should not be justified in allowing the papers to pass me without an expression of my views on the subject.

Minute by Chief
Magistrate.

The main object of Government in executing this work, viz. the Drainage and Warping up of the Salt Water Lake, is to improve the salubrity of the Capital. This is an object which is of course of chief importance to the inhabitants of the Town. And I look upon it as absolutely necessary that the scheme itself, and the manner of its proposed execution, should be thoroughly unfolded to the inhabitants. It is quite possible that increased sources of malaria may arise while the work is in progress, and in the event of its being generally judged to have caused additional sickness, it would be satisfactory to Government to reflect, that the public had not been taken by surprise. It is quite possible, that an extended rice marsh, into which, it is probable that the Salt Lake would, in time, be converted, might not be less productive of noxious vapour than the surface of a Salt Lake; and I think every opportunity should be afforded for the thorough discussion of these questions by the parties most deeply interested, viz. the permanent inhabitants of Calcutta.

Supposing the desirableness of the plan to be gainsayed in no quarter, which I shall rejoice to find the case,—the next point is to settle how it can be best carried into effect. If the estimate of profits, formed by the Committee, be just, I think Government would not require to give themselves much more trouble about it. Some capitalists would soon undertake the job, with a far better chance of economical management than Government could ever hope to effect.

Rather than counsel Government to undertake it themselves, I would propose, that failing any private capitalist, a joint stock scheme be propounded for general consideration.

(Signed)

D. M'FARLAN,

Chief Magistrate.

(True Copy,)

(Signed)

G. YOUNG,

Secretary Military Board.

(True Copy,)

(Signed)

T. H. MADDOCK,

Offg. Secy. to the Govt. of India.

No. VII.

EXTRACT FROM A DISPATCH, TO THE HONORABLE THE COURT OF
DIRECTORS, OF THE EAST INDIA COMPANY IN THE REVENUE DE-
PARTMENT, DATED THE 23RD DECEMBER, 1835. No. 10.

Drainage of Salt-
water Lake.

76. The Dispatch of your Honorable Court (No. 1, of 1830,) dated the 10th November 1830, on the subject of Draining the Salt-water Lake in the vicinity of Calcutta, and improving the course of the Circular Canal, having reached the Presidency during the absence of the Right Honorable the late Governor General at Simla, the subject was referred for his Lordship's consideration; and the consideration thereof, was, by him, suspended until his return to Calcutta,—when the whole papers connected with it, were transferred, through his Lordship's Private Secretary, to the Military Board.

* Captain W. N.
Forbes, Captain
Thomson, and Mr.
James Prinsep.

77. As a preliminary step, the Board referred the subject for report to a Committee, consisting of the officers named in the margin,* with orders to report their opinion on the following points.

First. As to the expediency of undertaking the work with reference to its probable influence on the health of the Inhabitants of Calcutta, and to the return which may be expected from the outlay.

Second. On the best mode of executing the work.

Third. On the expence and length of time that would be required for its completion.

Lastly. On the effect it would have on the Drainage of Calcutta.

78. The above named Committee reported that entirely banking out salt water and effectually draining off rain, and alluvion charged river water, would most materially improve the salubrity of Calcutta, and of the country adjacent. The Committee felt it difficult to appreciate the improvement, or accurately to estimate the value of the reclaimed land, but they believed, from the statements of the executive officers, that the objects contemplated might be effected with a return of 10 per cent on the outlay.

79. In the opinion of the Committee, the best mode of executing the work would be, by banking out the salt water, and by providing sluices for the discharge, at ebb tide, of rain water, or of alluvion charged water admitted by the Canal, and by a feeder, to be constructed so as to join the Hooghly and the Upper end of the Lake, for the purposes of irrigation, of ameliorating the soil, and of raising the level of the bed of the Lakes by warping.

80. The expence of the work the Committee estimated at 2 lacs of rupees, exclusive of the purchase of the land,—and they were of opinion that a period of five years would be required to complete the entire work.

81. The Committee did not contemplate that the drainage of that part of Calcutta lying to the Northward of the Durrumtollah road would in any way be affected by the

works proposed, but they were of opinion that the drainage of the ground situated to the Southward of that road might be much improved by them, as they would afford an increased fall of from 2 to 3 feet.

82. For the opinions entertained by the Members of the Military Board on the scheme presented by the Committee, we beg permission to refer your Honorable Court to their letter dated the 7th February 1834, enclosing the separate Minutes of their Members. These papers were all brought upon record on the 5th March last, but no orders were passed upon them by the Right Honorable the late Governor General in Council, and the subject has not since been resumed by us.

(A true Copy.)

(Signed)

T. H. MADDOCK,
Secretary to the Govt. of India.

Mis. Rev. Cons.
6th March, 1835,
No. 8 to 11.

No. VIII.

[EXTRACT OF A LETTER FROM MR. SECRETARY R. D. MANGLES TO THE MILITARY BOARD, TRANSMITTING A DISPATCH, DATED 18TH JANUARY 1837, FROM THE HONORABLE COURT OF DIRECTORS, TO THE ADDRESS OF THE GOVERNMENT OF INDIA.]

No. 636.

Govt. of Bengal,
Miscellaneous, Revenue.
Proc. 9th May, 1837. No. 5.

The information called for in paragraphs 27 and 28, of the Honorable Court's present Dispatch, relates to the Draining of the Salt Water Lake, adverted to in your Board's letter No. 4614, dated the 7th of February 1834. That communication, with the measures proposed by the Committee appointed to report on the subject, was brought to the notice of the Honorable Court in a Dispatch of the Council of India, dated the 23rd of December 1835, but as no reply has yet been received to that Dispatch, his Lordship deems it unnecessary to revive the subject at present.

I have, &c.

R. D. MANGLES,
Secy. Govt. of Bengal.

See Miscellaneous Revenue, Consultation of the Government of India, 5th March 1835, Nos. 8 to 11—Paragraphs 76 to 82 of No. 10.

No. VIII. (A.)

[*Extract of a Dispatch from the Honorable Court of Directors, to the address of the Government of India. No. 2, of 1837. Revenue Department.*]

Para. 27. In our Dispatch, dated the 10th November 1830, in which we took into consideration the proposal of the late Governor General, to change the original plan of the Eastern Canal by making it pass to the Westward of the Salt Water Lake, instead of through it,—we directed you, in the event of your undertaking the work, to be specially careful “to obtain the most absolute accuracy in respect of the Soil and the Levels.”

28. We desire to be informed if those directions have been attended to, and what are the results.

LONDON,
18th January, 1837.

REVENUE DEPARTMENT,
9th May, 1837.

We are, &c.
(True Copy) (Signed) W. H. MACNAGHTEN,
Secretary to the Govt. of India.
(True Copy) (Signed) ROSS D. MANGLES,
Secretary to the Govt. of Bengal.

No. IX.

EXTRACT FROM A DISPATCH FROM THE HONORABLE COURT OF DIRECTORS, No. 4, DATED THE 2ND MAY, 1838, IN THE REVENUE DEPARTMENT.

* Captain W. N. Forbes, Captain Thomson, Mr. J. Prinsep.
- Paras. 76 to 82 of Dispatch of the Council of India of the 23d December, 1835; Drainage of the Salt Water Lake.

Para. 41. The Committee, to whom the consideration of this subject was referred,* reported that the work would unquestionably most materially improve the salubrity of Calcutta and the country adjacent; that the best mode of proceeding would be by “embanking out the Salt Water, and by providing sluices for the discharge at ebb-tide of rain-water or of alluvion-charged water, admitted by the Canal, and by a feeder, joining the Hooghly and the upper end of the Lake, for the purposes of irrigation, of ameliorating the soil, and of raising the level of the bed of the Lakes by warping;” that the probable expense, exclusive of the purchase of land, and exclusive of the feeder, would be about two lacs of Rupees; and that it would require a period of five years to complete the work.

42. Colonel Galloway objected to the plan of embanking, and maintained, in an able Minute, that the first step to be taken ought to be a process of warping to extend over a certain portion of the Lake; which, if successful, would reclaim about 10,000 begahs of the most valuable part, and do more than defray the expense.

43. We find Colonel Anbury, the chief engineer, also differing from the Committee, whose report he designated as “altogether undigested” and “unexplained.”

44. Colonel Craigie, on the contrary, we observe, applauds the Report of the Committee, and recommends its publication ;—while the chief magistrate, Mr. McFarlan, throws out a somewhat important suggestion, viz. that “ It is quite possible that an extended rice marsh, into which it is probable that the Salt Water Lake would in time be converted, “ might not be less productive of noxious vapour, than the surface of a Salt Lake.”

45. On the general subject of the paragraphs before us, you are already in possession of our sentiments, and we do not see occasion, from a perusal of the documents now transmitted, which are unaccompanied by the expression of any opinion on the part of your Government, to add to the instructions contained in our dispatch of the 10th November, 1830.

46. You have not, it appears, taken any proceeding in the matter, beyond recording the reports and opinions above referred to ; we think on a subject so immediately interesting to the resident public of Calcutta, the greatest possible degree of publicity should be given to the information you have obtained, and we are inclined to the opinion expressed by Mr. McFarlan, that if it can be made apparent that the undertaking will produce a return of ten per cent. on the outlay, there will be no want of capitalists to secure the completion of the work without the interference of your Government.

(True Extract.) FRED. JAS. HALLIDAY,

REVENUE DEPARTMENT,
18th September, 1838.

Secretary to the Govt. of Bengal.

No. X.

EXTRACT FROM A RESOLUTION BY THE HONORABLE THE PRESIDENT OF THE COUNCIL OF INDIA IN COUNCIL, IN THE REVENUE DE- PARTMENT, DATED THE 20TH AUGUST, 1838.

Para. 5. With reference to paragraph 46, the Honorable the President in Council resolves—That copies of the papers noted on the margin, be forwarded to the Government of Bengal, with a request that those papers, with an extract (Para. 41 to 46,) from the Honorable Court's Dispatch, and all papers relative to the Drainage of the Salt Water Lake, recorded on the proceedings of the Bengal Government, may be forwarded for the consideration, and the Report of the General Committee of Municipal Inquiry now sitting in Calcutta.

India Miscellane-
ous Revenue. Con-
sultation.
5th March, 1835.
Nos. 8 to 11.

(True Extract,)

REVENUE DEPARTMENT,
18th Sept., 1838.

F. J. HALLIDAY,
Secy. to the Govt. of Bengal.

No. XI.

To THE MUNICIPAL COMMITTEE.

No. 1647.

Revenue Department.

GENTLEMEN,

I am directed by the Honorable the Deputy Governor of Bengal, to transmit the papers noted on the margin,* relative to the Drainage of the Salt Water Lake, and to state, that his Honor will be happy to be favored with the Committee's opinion on the subject.

I have the honor to be, Gentlemen,

Your obedient humble Servant,

FRED. JAS. HALLIDAY,

Secretary to the Govt. of Bengal.

FORT WILLIAM,
18th September, 1838.

* Some of the official papers which have been printed thus far in this Appendix, and not noted as having been transmitted with the above letter of Mr. Secretary Halliday, have since been obtained from his Department; while others have been obtained from the Military Board, and elsewhere.

Recorded papers of
16th Feb. 1830,
Nos. 7 to 14.

† Ditto, of 9th
May 1837. No. 5.

‡ Ditto, 12th Sep-
tember 1837.

No. 1 to 5.
Extract from Ho-
norable Court's Dis-
patch No. 4 of 2nd
May 1838, para-
graphs 41 to 46.

Extract from a
Resolution by the
Honorable the Pre-
sident of the Coun-
cil of India, in
Council, in the Re-
venue Department,
under date the 20th
August 1838, with
copies of the Pa-
pers therein refer-
red to.

† A portion of this Paper, printed at pages 54-55— but the whole will be found printed in Appendix to Appendix (G), Vide page

‡ This Paper will be found printed in Appendix to Appendix (G) Vide page —J. M.

APPENDIX

TO

APPENDIX G.

